State of Rhode Island and Providence Plantations.

STATE BOARD OF AGRICULTURE,

JOHN J. DUNN, Secretary.

SOME SUGGESTIONS

FOR

RHODE ISLAND APPLE GROWERS.

A. E. STENE.

Abstract from Report of State Board of Agriculture for 1909.

PROVIDENCE, R. I.
E. L. FREEMAN COMPANY, STATE PRINTERS.
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PLATE I. Russets—"Look good enough to eat!" After R. I. Exp. Sta.

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SOME SUGGESTIONS ON APPLE GROWING IN RHODE ISLAND.

BY A. E. STENE.

INTRODUCTION.

During the last few years there has been an awakening of interest in the growing of apples throughout the country. New England has been no exception, and at the present time the writer is receiving numerous inquiries, almost every day, verbally and by letter, from people in various parts of the State who are studying the question of apple growing.

This bulletin is written in the hope that it may answer some of the many questions which the people are asking. The subject of apple growing is a very large one, and it is manifestly impossible to cover it thoroughly in a bulletin, or even in a single book. There are also a great many mooted questions which must be left to the future to settle. These points should be borne in mind in reading the bulletin, and the directions herein given should be taken as suggestions merely, and not, except possibly in some cases, as the final word on the topics discussed.

Advice can usually be given only in general terms. A locality or farm is a problem unto itself, and after the prospective grower has exhausted all possible information, oral and written, he must set to work to solve the specific problems of his own capabilities and of his own farm.

It should also be remembered that while we can judge a good deal of the future through a thorough knowledge of the past, yet no hard and fast rules or directions for all times can be based on past ex-

periences. Agriculture is rapidly developing. The theories and practices of to-day may be changed more or less to-morrow. Even the attitude of the people may change toward varieties of fruit, as it does toward fashions in clothes or other matters. Red apples of certain varieties are in demand to-day, but they may not be so much so twenty-five years from now.

This bulletin does not pretend to reveal anything new in regard to orcharding. It is primarily intended as a guide to the amateur or beginner, who is looking for information regarding orchard work under Rhode Island conditions. There will probably be little of special interest to the old, experienced growers. They have solved their primary problems to a greater or less extent, and have little need of consulting bulletins of general advice. Their problems are not the beginner's, or general, but advanced and special, and solutions for them must be gained largely through their own efforts and through work now in progress, or to be undertaken, by experiment stations.

Those seeking information from this bulletin will undoubtedly look in vain for suggestions on many points—even some of elementary scope—relating to apple growing. No one can be more fully aware of such deficiencies than the writer. The time available for the arrangement of the material, as well as the limitation of size, has compelled the omission of much information which was originally gathered with the intention of putting it into the bulletin.

THE FINANCIAL OUTLOOK IN ORCHARDING.

One of the first questions that a prospective orchardist will ask is: "Will orcharding pay?" A discussion of this question naturally divides itself into two parts: what does it cost to establish an orchard; and what are the probable financial returns?

Cost of Establishing an Orchard.

As with other problems which depend upon the many factors of climate, soil, and the personal equation of the manager, it is im-

possible to present figures which can be considered even approximately exact. Everyone is well aware that at the present time orcharding is presented in a favorable aspect financially. The temptation among writers, especially those who write for popular magazines and papers, is to paint the outlook in a most roseate hue. The figures given are not necessarily untrue, but they are likely to be based upon the exceptional results rather than on those secured under average conditions and by the average person. Much of the information scattered broadcast throughout the land is also influenced by people who are interested in the settlement of different sections of the country, or in promoting the sale of land. Such people lose no opportunity to publish phenomenal yields or great financial returns, while nothing is said of the failures or mediocre results in the same localities.

Much also depends upon the condition of the land and the plan under which the orcharding is carried on. One grower believes in clearing his land thoroughly of rocks, stumps, and rubbish of every kind that will interfere with cultivation, before planting his trees. Another removes the timber, burns over the ground so far as possible, plants his trees, and then for a number of years simply cuts the brush and weeds that spring up. He will eventually clear the ground for cultivation, but will let time help him to do the work as cheaply as possible.

The following estimates will give an idea of the cost of the principal items in establishing an orchard, and from these anyone can determine for himself the probable expenditures under his own conditions:

Trees may be purchased at from 15 to 20 cents apiece. For the first year, the planting should cost from 5 to 10 cents a tree; the fertilizer from 1½ to 2 cents a tree; cultivation from $2 to $3 per acre; wire netting to protect trees from mice and other rodents, 10 cents per tree. In the expenditures for succeeding years should be counted the cost of replacing dead trees—an item which cannot be estimated; additional fertilizer from 2 to 4 cents per tree; cultivation, $3 per acre;

and spraying, from 5 to 20 cents per tree. Succeeding years will add the cost of pruning, which will be a continually increasing item and may be estimated at from 5 to 25 cents per tree. Additional fertilizer will be necessary, as will also more work in connection with spraying.

A writer from Nova Scotia, in an article in the American Cyclopedia of Agriculture, estimates the cost of a 10-acre orchard in his locality at $124 for the first year; $32.50 for the second; and $44.25 for the third. This estimate is probably rather low under Rhode Island conditions.

None of these estimates take into consideration the cost of the land, preparation of the land, tools, or interest on investment.

INCOME FROM ORCHARDS.

To attempt to give exact figures from returns is fully as difficult as estimating the cost of establishing an orchard. The factors of natural environment, climate, etc., mentioned in the previous discussion must be considered here, and in addition, the question of variety, individual fruitfulness of trees, availability of markets and the probable future supply and demand, and, finally, the business ability of the orchardist in harvesting and marketing his crop.

Those who have bearing orchards at the present time are getting splendid returns from them. Figures in papers from the Pacific Northwest, where fruit growing has become a highly developed specialty, are sometimes astonishing. It is common to read reports of bearing orchards which have been sold for from one to two thousand dollars per acre, and, considering the income which has been derived from these orchards during the past two years, the price is not excessive.

Similar, though not quite so favorable, reports have been published here in the East. ' Edwin Hoyt, New Canaan, Connecticut, in an article in the report of the Rhode Island State Board of Agriculture, writes that he picked 12 barrels per tree from trees set 15 years; and that Benjamin Hoyt of the same place, from 90 trees set 18 feet apart, picked, the sixth year, 180 bushels, and the eighth year, 206

bushels. Frank Olmsted of Ontario county, New York, sold 379 barrels from a 1½-acre orchard, which netted him over $900. George T. Powell, in a recent letter writes of two Baldwin trees from which the apples brought $110; and of a Mr. Delos Tenny, Orleans county, New York, as having sold his Northern Spy apples from 20 trees for $1,000. He mentions another grower who sold Baldwins from 25 trees for $1,000. Mr. Powell says that he has in his orchard King trees 18 years old that will bring $40 a tree.

A Mr. Miller of West Virginia sold 6,000 barrels of apples from a 34-acre orchard 20 years old. Professor U. P. Hedrick, New York Experiment Station, says in a letter that he knows a man with 20 acres of Baldwin trees, 50 years old, who derives a good income from his orchard at a capitalization of $200 per tree. Another writer states that a 9-year-old orchard should net $90 per acre, and a 12-year-old orchard, $150 per acre.

Some of these yields are undoubtedly exceptional both as to the early bearing of the trees and the quantity of the fruit and are the results of very high culture, up-to-date methods, and favorable conditions. It can be safely said, however, that with good culture, under average conditions, early-bearing apples ought to begin to produce fruit at from 5 to 6 years of age, and later-bearing varieties at from 8 to 10 years. An extensive orchardist in Massachusetts recently stated that he should expect an early-bearing tree to yield a barrel of first-class apples, exclusive of windfalls and culls, at 8 years old, and the later-bearing one to yield the same amount at 10 years old. It is probably safe to estimate that trees thereafter should yield an additional quantity of from 1 to 2 barrels for every two years added to their age up to the time when they reach their maximum yield.

An inquiry was made by the writer, two years ago, to ascertain the value of apple trees at different ages. These figures were secured from well-known horticulturists and fruit growers in six different localities, and since they may throw some light on the probable value of orchards as determined in each case by the income from trees in the section where the writer was located, they will be inserted here.

		Eastern New York.	Central New York.	Western New York.	Vermont.	Massachusetts.	Rhode Island.
Early bearing trees, example: Wealthy.	2 yrs. old..	$1 50	$2 00	$2 00	$2 00	$2 00	$3 00
	4 " " ..	4 00	4 00	4 00	5 00	3 00	5 00
	6 " " ..	6 00	6 00	6 00	7 00	5 00	10 00
	8 " " ..	8 00	10 00	8 00	10 00	7 00	15 00
	10 " " ..	22 00	12 00	10 00	15 00	12 00	25 00
	12 " " ..	23 00	15 00	12 00	17 00	15 00	50 00
	15 " " ..	33 00	20 00	15 00	20 00	20 00	75 00
	20 " " ..	36 00	30 00	20 00	20 00	30 00	100 00
	25 " " ..	42 00	40 00	25 00	18 00	40 00	100 00
	30 " " ..	55 00	50 00	30 00	15 00	60 00	100 00
	35 " " ..	55 00	60 00	30 00	12 00	80 00	100 00
	40 " " ..	55 00	70 00	35 00	10 00	100 00	100 00
Later bearing trees, example: Baldwin & Greening.	4 yrs. old..	$4 00	$5 00	$4 00	$5 00	$5 00	$3 00
	6 " " ..	6 00	7 00	8 00	7 00	7 00	5 00
	8 " " ..	8 00	12 00	8 00	10 00	10 00	10 00
	10 " " ..	20 00	15 00	10 00	15 00	12 00	15 00
	20 " " ..	60 00	40 00	20 00	25 00	50 00	75 00
	30 " " ..	75 00	80 00	30 00	35 00	100 00	90 00
	40 " " ..	73 00	125 00	30 00	50 00	150 00	90 00
	60 " " ..	70 00	150 00	.....	45 00	250 00	90 00

The present favorable returns from orchard ventures are due, in part at least, to a diminished supply and an increased demand for fruit. During the period of thirteen years previous to last year, the total production of the United States decreased over 50 per cent. The question naturally arises whether the present extensive planting which is being carried on in all the apple-growing sections of the country will not eventually increase the supply so that it will be greater than the demand. The supply now, however, is so far short of the actual demand that it will take a great deal of fruit to supply enough even for the present consumption. If we take into consideration also that the population of the country is rapidly increasing; that people are using more and more fruit; that a greater variety

FIG. 1. Types of neglected apple trees.

FIG. 2. Apple tree dating back to Revolutionary times. · *Boss Homestead, North Scituate, R. I.*

PLATE II.

of uses is found for apples and better methods of utilizing the by-products are being established; and, finally, the rapidly growing demand for our apples in foreign countries, it is safe to say that there will have to be a tremendous increase in production in 15 or 20 years, when the orchards now planted will come into bearing, in order to supply the natural demands. If we consider also that a great many who are now taking up orcharding will be disappointed in their ventures and neglect their trees, we may conclude that there is not such a very great danger from over-production. Furthermore, it should be remembered that fruit products of the highest quality marketed in an attractive manner will probably always bring a remunerative return, even though the general production may be in excess of the demands.

Anyone who takes up orcharding in dead earnest, and with a determination to stick to the business and grow the best possible quality of fruit, can, without doubt, make it a success.

ORCHARDING IN RHODE ISLAND.

PRESENT STATUS OF INDUSTRY.

Anyone traveling about the State cannot help but notice that the farmsteads have undoubtedly at one time had flourishing apple orchards of a greater or less number of trees. The size of the trees indicates that these orchards must have been planted from fifty to seventy-five years ago. They were largely home orchards set out for the purpose of furnishing fruit for the family, and were made up of a number of varieties. On account of the poor markets and the inefficient methods of distributing fruit, there were no commercial orchards, and fruit not used by the family or in the immediate neighborhood was generally made into cider. Even the evaporated fruit industry, now quite flourishing in some apple-growing sections of other states, is of very recent development.

During the last twenty or thirty years some planting has been done by our farmers, but there have not been many orchards of any size established. Within the last ten or fifteen years the introduction of the San Jose scale placed a decided damper upon the enthusiasm of a

great many growers, and to-day the number of apple trees in the State is probably smaller than at any time during the past century. Owing to the increased price of orchard products and the development of better methods of treating the San Jose scale, orchardists are now beginning to feel that the planting of apples is a safe venture, and many are already setting out orchards, or planning to do so in the near future.

ADAPTABILITY OF RHODE ISLAND FOR APPLE GROWING.

Recent discussion seems to show that while the West has, during the past few years, been a very successful competitor of the East in the large markets of the country, this has been in part the result of special methods, and not wholly owing to the greater adaptability of the former region over the latter. It has also been conceded that the quality of the eastern fruit is equal, if not superior, to that of the West. The past history of orcharding in the State also seems to indicate that apple growing is possible over a very large part of Rhode Island territory.

It may be doubted if the industry is destined to become commercially profitable on some of the poorer and low-lying land of the State in close proximity to the ocean or to Narragansett Bay. There is no question, however, but that the rolling and hilly lands of the northern and western portions of the State, including nearly all of Providence county, the western two-thirds of Kent county, and perhaps also the section of Washington county lying to the north and west of the New Haven railroad, may be made to produce good fruit. At least this proposition cannot be gainsaid—that some of this land is better adapted to orcharding than to any other line of farming; and the success of a few up-to-date orchards in this territory is an indication that such orchards can be made financially profitable.

THE SUPPLY AND DEMAND FOR APPLES IN RHODE ISLAND MARKETS.

In 1895, according to figures submitted by the Commissioner of Industrial Statistics, there were grown in Rhode Island 103,648

FIG. 1. A well-managed orchard owned by *E. Cyrus Miller, Haydenville, Mass.*

FIG. 2. A promising crop on Rhode Island trees. *The Whipple Orchard, Cumberland.*

PLATE III.

bushels of apples which were used for cider, and 128,087 bushels for other purposes; or a total of 231,735 bushels. In 1889 and 1899, according to the U. S. Census, 239,367 and 339,445 bushels of apples, respectively, were grown, and in 1905, according to the State census, 251,094 bushels, indicating that there has probably been no appreciable increase in production during the last ten or fifteen years.

That the quantity now produced is in no way sufficient to supply the markets of the State is shown by the following report from the freight agent of the New York, New Haven, and Hartford Railroad, in Providence:

APPLES IN CARLOAD LOTS BROUGHT INTO PROVIDENCE FROM OTHER STATES.

1909.		
January	28	carloads.
February	22	"
March	9	"
April	3	"
May	0	"
June	0	"
July	0	"
August	1	"
September	10	"
October	93	"
November	114	"
December	37	"
Total	317	"

If we multiply this sum by 150, the minimum number of barrels in a carload, we get 47,550 barrels (142,650 bushels) as the total quantity of apples brought into the State in carload lots.

It will be noted that this considers only apples imported in carload lots and does not include smaller shipments which, if added, would probably increase the total number of bushels of apples 40 to 50 per cent.

It is evident from these figures that the present orchard area of Rhode Island may be doubled without creating an over-production

for the home markets, and this does not take into consideration probable natural increase in demand for the future.

PURCHASE OF NURSERY STOCK.

This is an item which should be given very careful consideration. The character of the stock may determine whether the orchardist's efforts will be crowned with success or end in a failure.

Under no circumstances should stock be purchased simply because it is cheap. Aside from securing good, thrifty stock, it is important to secure trees that are true to name. For this there is no guarantee other than the character of the nurseryman, and it is vitally important, therefore, to purchase only from growers who have a good, established reputation to maintain.

The locality in which the stock is grown is not of very great importance, although for apples it is perhaps best to purchase them from northern nurseries. When only a few trees are wanted there is an advantage in purchasing from local nurseries in that one can go into the nursery rows and select his trees.

During the last few years there has been quite a little discussion as to whether one- or two-year-old stock should be purchased. It is claimed for the latter that the additional cost is small, and the period of waiting for the orchard to come into bearing is shortened. The disadvantages of the two-year-old stock are that heads are frequently formed too far from the ground, and the shock of transplanting is greater. On the other hand, the one-year-old stock can be more readily trained into the shape of tree desired, and the transplanting is more readily accomplished, so that the difference in age does not mean as much as the length of time would seem to signify. Much depends, of course, on the size and vigor of the trees at both ages.

Another point which is coming to the front rapidly at the present time is the value of selecting scions. It is a fact well known to orchardists that individual trees of the same variety vary greatly in their productivity and other important points. It is argued, and with considerable foundation, that scions selected from a good tree

are much more likely to produce new trees with desirable characteristics than scions taken from poor trees. If this is true, it is unwise, as has been practiced in the past, to take scions at random from trees growing in the nursery rows and from orchards where the bearing habits of the trees are not known. A few of our nurserymen are beginning to recognize this theory, and are using great care in securing their scions. The cost of the resulting trees is but very little greater than of those propagated in the old-fashioned way, and it is well to give the theory the benefit of the doubt, and secure, when possible, trees from nurserymen who take this principle into consideration.

It is also well to remember that some varieties do best when top worked on some other more vigorous stock. For instance, the King, so popular in New York, is found to do but poorly, owing to the attack of collar rot, when propagated in the ordinary manner with root graft. This trouble is prevented by top grafting on a vigorous variety, such as the Northern Spy, or the Tolman. The McIntosh is another variety which it is believed will do best when propagated in the same way.

The following summary gives the gist of what one should consider in purchasing nursery stock:

*"In ordering trees the following directions, if observed, will go far towards eliminating many unpleasant experiences:

"1. Order direct from a firm of good standing, which grows its own stock or has it grown by contract.

"2. Buy of local nurseryman if he fulfills these conditions.

"3. Place your order early.

"4. State specifically what you want, both as to the varieties and style and class of stock. Don't leave any room for supposition.

"5. Give explicit shipping directions and state just when you wish stock delivered.

"6. Remember that the purchase price of trees is a small part of the orchard cost. A few dollars extra spent for trees, if it will purchase just what you want, will be well spent.

"7. Make it your business to see that trees are not delayed in transit.

*From address by Prof. W. J. Wright of the Pennsylvania State College, (The Fruit Grower, Feb., 1910.)

"8. Carry out your part of the contract by seeing that the trees are well cared for on arrival, and that they are properly planted."

And to these might be added: examine your trees carefully on arrival to see that they are not infested with the San Jose scale or other injurious insects or affected with crown gall or other fungous diseases.

Give all peripatetic tree agents, who present new and extraordinary varieties or special schemes for establishing orchards on the cash and crop payment plans, an emphatic suggestion for a hasty departure.

VARIETIES.

In determining what varieties should be planted, the adaptation to soil and climatic conditions must be considered; also the market demands, and the personal equation of the grower. Anyone wishing to plant an orchard should decide at the outset whether it is to be a commercial venture or merely an orchard for the supply of home consumption. In the first case, he must confine himself to a few standard varieties which are known to be productive in the locality and the fruit of which is known and readily sold in the markets. If a home orchard is desired, the tastes of the owner and his family should be the guide to the selection of varieties.

Among commercial varieties to-day the Baldwin is undoubtedly without a competitor in the minds of a majority of the best orchardists in New England. It has a good color, which is one of the important characteristics in a market apple, is of fair quality, productive, vigorous, and adapts itself to a variety of soils.

The Greening is considered by many to be a better apple in every way than the Baldwin, but lacks one qualification for a market apple, namely, the red color. It is being planted, however, quite extensively, in the hope that market demands will change in the future so that quality will be of more importance than appearance.

Aside from these two, no one variety seems to meet with the approval of a majority of the fruit growers for a permanent orchard plantation. Among the varieties that are in favor in one section or another of New England may be mentioned the Northern Spy, York Imperial, Sutton, Fameuse, King, Roxbury Russet, and Ben Davis;

and among the sweet apples, Tolman Sweet, Bailey Sweet, Bentley Sweet—a favorite of Van Deman, and Lady Sweet—a favorite of Downing. Wagener, Bellflower, Black Gilliflower, Peck Pleasant, Mother, Delicious, and Rome Beauty also have their advocates.

Summer and fall apples are not favorably considered for commercial orchards, except to a limited extent in those located near large cities where the orchardist can cater to a few private customers, or to special dealers.

For summer apples, Williams, Red Astrachan, and Yellow Transparent are the best known. For fall apples, the Duchess, Gravenstein, McIntosh, and Wealthy are among the best.

The following is a list of some of the principal varieties of apples grown in New England, as indicated by the premium lists of fruit shows and agricultural fairs. There are over 1,000 varieties of apples offered for sale in America, and this list is therefore a very brief one.

For convenience it has been arranged under a rough classification. It should be remembered that any classification based on variations in color or in sweetness and acidity is more or less arbitrary, and in many varieties there is no well-defined point of division between the characteristics on which the classification is based.

I. SUMMER AND FALL APPLES.

A. *Sweet.*

a. Green or yellowish-white, with no red color except sometimes a blush towards the sun.

Autumn Bough,
Bough Sweet,
Golden Sweet,
Pumpkin Sweet,
Spice Sweeting,
Yellow Sweeting.

B. *With more or less acidity.*

a. Green or yellowish-white, with no red color except sometimes a blush towards the sun.

Cheeseboro Russet,
Early Harvest,
Fall Pippin,
Keswick,
Longfield,
Maiden Blush,
Porter,
Primate,
Summer Pippin (Sour Bough),
Yellow Transparent.

b. Striped or splashed with more or less red.

Alexander,
Bismark,
Charlamoff,
Chenango,
Early Strawberry,
Early William,
Fameuse (Snow),
Fanny,
Gideon,
Gravenstein,
Garden Royal,
Summer Pearmain,
Haas,
Hibernal,
Hurlburt,
Jefferis,
Oldenburg,
Red Astrachan,
Sapson,
Sops of Wine,
Tetofski,
Washington Strawberry,
Williams.

II. WINTER APPLES.

A. *Sweet.*

a. Green or yellowish-white, with no red color except sometimes a blush towards the sun.

Danvers Winter Sweet,
Green Sweet,
Honey Greening,
Jacobs Sweet,
Leicester Sweet,
Tolman Sweet.

b. Striped or splashed with more or less red.

Bailey Sweet,
Isham Sweet,
Lady Sweet,
Lady Sweeting.

B. *With more or less acidity.*

a. Green or yellowish-white, with no red color except sometimes a blush towards the sun.

American Golden Russet,
Bellflower,
Bietigheimer,
Canada Reinette,
Fallawater,
Gloria Mundi,
Golden Russet,
Grimes Golden,
Lady,
Lady Apple,
McMahon,
Malinda,
Mann,
New York Pippin (Newtown Pippin),
Northwestern Greening,
Peck Pleasant,
Pomme Gris,
Red Russet,
Rhode Island Greening,
Ridge Pippin,
Roxbury,
Winter Banana,
Yellow Bellflower,
Yellow Newtown (Albemarle).

b. Striped or splashed with more or less red.

Baker,
Baldwin,
Ben Davis,
Black Gilliflower,
Black Oxford,
Blenheim,
Blue Pearmain,
Canada Red,
Cogswell,
Domine,
Esopus Spitzenburg,
Fleishing Spitzenburg,
Gano,
Granite Beauty,
Herefordshire,
Hubbardston,
Jonathan,
King,
Limbertwig,
McIntosh,
McLellan,
Milden or Milding,
Minister,
Mother,
Nodhead,
Northern Spy,
Opalescent,
Pewaukee,
Ralls Genet (Janet, Neverfail),
Rambo,
Rolfe (Macomber),
Saint Lawrence,
Scott Winter,
Shiawassee,
Stark,
Starkey,
Stayman Winesap,
Sutton,
Twenty Ounce (Cayuga Redstreak),
Twenty Ounce Pippin,
Vandevere,
Wagener,
Walbridge (Edgar Redstreak),
Wealthy,
Westfield (Seek-no-further),
Winesap,
Wolf River,
York Imperial.

SOIL AND SITE.

The ideal soil for apple orchards is considered to be a deep, clayey loam, not too compact, of limestone origin. It has been found, however, that similar loams of a granitic origin if they are limed will produce equally good results. One writer says that land which will grow good corn is all right for an orchard. Another avers that his ideal for an orchard is soil that will grow first-class potatoes. Both are approximately correct.

Loose, sandy soils, and soils which are not well underdrained, should be avoided. The latter kind can, of course, be used, if they are drained artificially. The Gloucester Stony Loam of Rhode Island

seems to be very well adapted for apples, since our best orchards are found in this kind of soil.

In the northern part of the Mississippi Valley the site of an orchard is all-important. It has been found that success, if attained at all, is usually gotten on a northern or eastern slope. In New England this idea does not seems to be very important, and if it has any weight it lies rather with the opposite aspects, namely, a southern or western slope, for the reason that such aspects possibly favor a little the development of better color. Of far more importance is the relation to the surrounding country. The best orchards are located on hillsides, and on comparatively high land with good water and air drainage. It is impossible to establish successful orchards on low, poorly drained land, or in hollows from which there is poor air drainage. A steep slope, however, should be avoided, if possible, since such a site generally makes cultivation inadvisable and all work in the orchard very difficult and expensive.

The only other point to be considered is that of the prevailing winds. Unless a windbreak can be taken advantage of or planted, it is well to select a site which will be protected from the prevailing storms of the locality, if this is possible.

PREPARATION OF NEW LAND.

The preparation of the land will depend on whether a mulch or clean culture system of management is to be carried on. It must be remembered, also, that under certain conditions, and this is especially true of many parts of this State, cultivation is out of the question, and it is possible in such places to have successful orchards under the mulch system. In either case, it is necessary to clear away trees, if present, and to cut the shrubs and weeds and burn all the rubbish possible. If cultivation is to be practiced from the very beginning, stumps and rocks should be taken out. This is sometimes very expensive, and some successful orchardists have simply cleared the land of trees and brush, burned it over, and planted the trees. See Plate V, Fig. 1. For a few years, sprouts and weeds are

cut and piled around the trees as a mulch, and by the time the trees have come into bearing, the stumps are more or less decayed so that they can be quite readily taken out. Rocks are also removed gradually, the work being done whenever an opportunity presents itself, and when it can be done most cheaply. By this method land can be made ready for clean culture by the time the trees come into bearing.

Where such land is to be cultivated from the beginning, it is usually well to plant it, if time permits, for one or two years with crops which will serve to bring the soil into good tillable condition. A grain, buckwheat, or millet crop for the first year, followed by a cultivated crop, such as corn or potatoes, will put the land into excellent condition for the planting of trees.

Land already under cultivation presents, of course, no special problems under this head.

THE PLANTING OF THE ORCHARD.

A GENERAL PLAN.

One of the first things to be done in setting out an orchard is to measure carefully the land which is to be planted. A plat should then be made showing the location of every tree and recording the position of all the varieties to be planted. This plat should be carefully followed in planting, and it should be preserved for future reference.

LAYING OUT THE ORCHARD.

Various plans for the laying out of an orchard have been suggested. Much depends upon the size of the orchard and on the contour of the land. For small orchards or for orchards which, on account of the lay of the land, cannot be laid out regularly, the method must be developed by each grower for himself. For larger orchards on level ground some helpful suggestions may be derived from systems described by Van Deman and Yeomans. The two are similar and briefly summarized are as follows:

A base line (See Fig. 1, A B) is laid out along the side of the field, or along a fence or a stonewall. Stakes are set at both extremities of

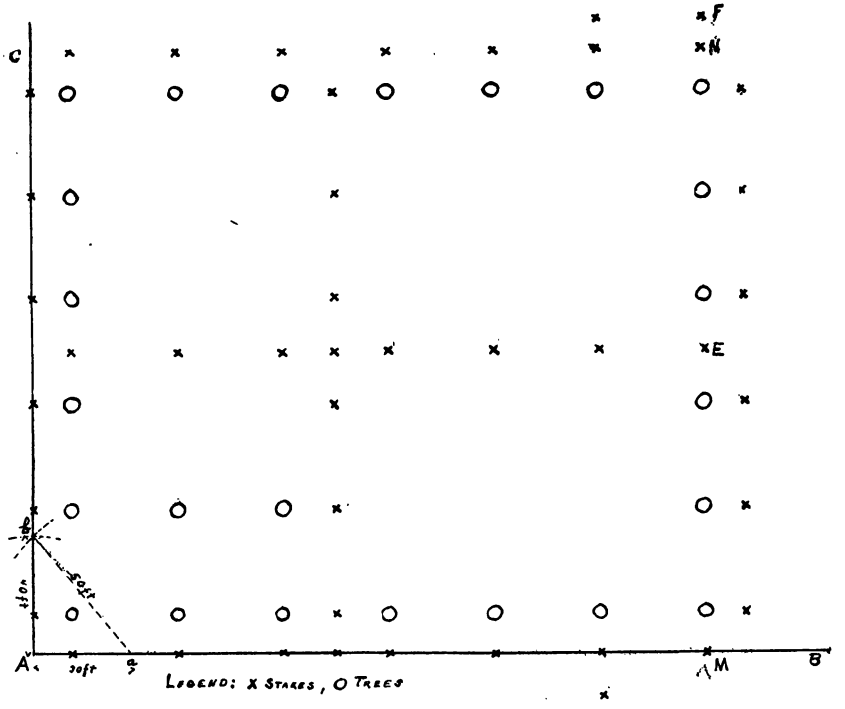

FIG. 1. Method of staking an orchard in a rectangular field.

this line, and a perpendicular (A C) to this line is erected at one end. This can be done by means of a common carpenter's square, sighting along both limbs, or by means of establishing a right angle as practiced by surveyors. The last mentioned method consists of measuring thirty feet along the base line, setting a stake (a), then with a distance of forty feet on the tape line and (A) as a center mark off a segment of an arc in the direction which the perpendicular will take (b), and with (a) as a pivotal point and a distance of fifty feet on the tape line, mark off another segment of the circle at (b), cutting the first segment. Set a stake at the intersection of the two segments, and by sighting over this from the original stake at the end of the base line, the perpendicular can be established. Now meas-

ure off on both the base line and the perpendicular the distance at which the first tree is to stand from these two lines, and set stakes. Again measure from these stakes distances equal to the distance which the trees are to stand apart, 15, 20, 30, or 40 feet, as the case may be. In a like manner, set stakes on the other two sides of the field and in both directions across the field about half-way between the opposite sides. A number of series of three stakes have now been set in the field, the intersections of the lines of which will mark the position of all the trees in the field.

Holes can be dug with a spade, or if conditions permit the field can be marked out and the soil partly removed for the trees with a plow. If the plow is to be used, employ two additional stakes in the following manner:

Starting at (M) Fig. 1, to plow in the direction of (N), let someone set a stake in line with the three original stakes but beyond (N) at (F). This stake is set in order that when the driver has passed the middle stake of the field at (E), he will still have two stakes with which to keep in line. Stakes are set in like manner for the other rows. The furrow can be gone over once or twice, and perhaps even the subsoil plow may be brought into use in order to prepare the

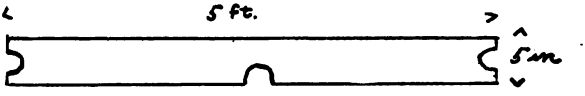

FIG. 2. Planting Board.

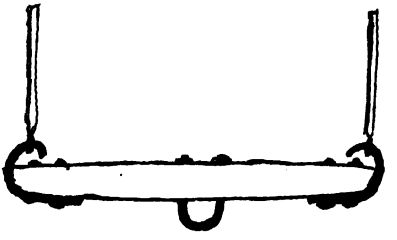

FIG. 3. A good form of orchard single-tree.

land for the planting of the trees. The furrows are run in one direction only.

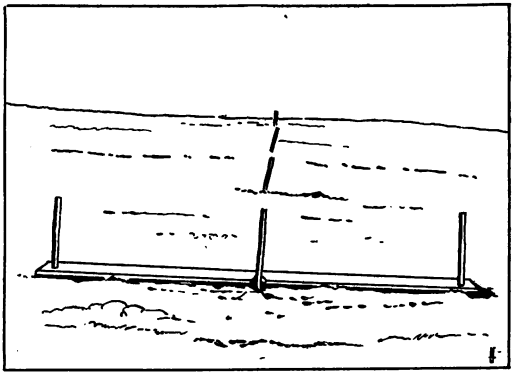

FIG. 4. Use of Planting Board.
Middle stake and board is removed while hole is dug. The board is then replaced and the tree is set at the notch in the board.

When the planting is begun three or four men can be used to advantage, one to distribute the trees and prune the roots, the second to hold the trees and to line them up in one direction, and to stamp in the soil over the roots; and the third to line them up in the other direction and shovel the soil around them.

After the trees are planted the furrows may be left to be leveled by cross cultivation, or they may be filled in with a plow, provided injury to the trees is prevented by the use of a short singletree, such as shown in Fig. 3. The danger of injury may be still further reduced by tying burlap around each end of the singletree.

Another method would be to mark off places for the trees as one would for corn, running the marker in two directions, stakes being used as guides in the same way as mentioned for the first plan.

Under any method where the field is marked off with a stake in each position where a tree is to be placed, the planting board method may be used. The construction of this planting board is shown in Fig. 2, and its use is also sufficiently illustrated in Fig. 4.

INTERPLANTING AND DISTANCE APART OF TREES.

Under the most favorable conditions, several years must elapse before an orchard of standard trees comes into bearing. In order that some returns may be secured from the land in the meantime, various systems of interplanting with other orchard trees, small fruit, or vegetables have been suggested and practiced.

A few years ago it was recommended that peaches should be grown among the permanent trees of the apple orchard; and while this seemed fairly satisfactory, the prevailing practice to-day is to interplant with early-bearing varieties of apples. For this purpose, Wealthy, Oldenburg, Wagener, Yellow Transparent, and even the much-maligned Ben Davis, are being used. Of these, the Wealthy and the Oldenburg are probably planted more than any of the others. The Wealthy is considered a splendid variety for this purpose. It is of good quality, good color, bears well, and will keep in ordinary cellar storage until January or February, and in cold storage as long as it may be necessary. In addition, the tree is an upright, compact grower, and will not interfere for a long time with the development of the permanent trees. For instance, Professor Waugh states that where a Baldwin tree may have a spread of thirty-five feet, a Wealthy of the same age would probably not exceed twenty-five feet.

The distance apart of the trees will vary with the condition of the soil and the kinds of trees planted. On strong, fertile soil, and with vigorous varieties, the distances recommended a decade or two ago are no longer considered adequate. The presence of the scale and the necessity for economizing in the harvesting of the fruit have compelled the orchardist to make trees as low-headed as possible, and this necessitates more room for the trees to spread out. As a result, where a distance of from thirty to thirty-five feet was recommended a few years ago, a distance of from forty to forty-five feet is now considered none too great. In Rhode Island, forty feet is perhaps the average distance to be recommended.

If interplanting is practiced, trees are planted between the per-

manent trees in the rows and between the rows. With the permanent trees forty feet apart, this makes a total of 108 trees to the acre. When the temporary trees are to be removed, the ones in the rows can be cut out first, leaving the orchard in the Quincunx system of planting until such a time as the permanent trees shall need all the ground. This interplanting may be intensified still further, as Powell recommends, by planting dwarf trees between the standard trees; or, as others recommend, by the planting of bush fruits, such as gooseberries or currants, between the trees in the rows, and by the planting of vegetables or strawberries between the rows.

If vegetables are used, only the low-growing ones should be chosen, and they should not be planted too close to the trees. Another point to be considered is the planting of early-maturing vegetables which will permit the sowing of a cover crop as soon after midsummer as possible. For this purpose radishes, lettuce, early peas, early sweet corn and cabbages are to be preferred to vegetables that require the whole season for their growth.

In connection with such interplanting it should be remembered that the welfare of the permanent trees of the orchard is to be considered first, and the growing of crops, other than apples, should be discontinued just as soon as the apple trees need the room.

NUMBER OF TREES REQUIRED TO SET AN ACRE OF GROUND AT GIVEN DISTANCES.

	Trees.
10 ft. x 10 ft.	435
10 ft. x 20 ft.	217
10 ft. x 40 ft.	108
20 ft. x 20 ft.	108
20 ft. x 40 ft.	54
40 ft. x 40 ft.	27

GENERAL SUGGESTIONS REGARDING PLANTING.

In planting trees of any kind, care should be used not to expose the roots to the drying effect of the air. It is an excellent plan,

FIG. 1. The beginning of an Orchard.

FIG. 2. The result of a few year's growth and work.

PLATE V. *Orchards of E. Cyrus Miller, Haydenville, Mass.*

although not always necessary, to cover the roots with a film of wet dirt by puddling them. In this way they are protected for a longer period against the drying effects of the wind while they are being planted.

In planting the trees it may be well to slant them slightly towards the direction from which the prevailing winds come, and one orchardist recommends that the lowest branch of the tree should be pointed in this direction. Long, straggling roots should be cut off, and if time permits, the bruised ends of others may be pruned back with a clean, sharp cut, but this is not emphasized so much now as it used to be. Of great importance is the manner in which the tree is set in the

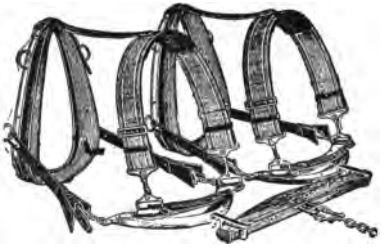

FIG. 5. Traceless Farm Harness.

ground. Good, fertile soil should be selected for immediate contact with the roots, and clods or lumps should be avoided. Tamp the soil in thoroughly around the plant. It would be difficult for anyone to firm the soil too much. The tree should be set just a little deeper than it stood in the nursery, and it may also be well to allow the soil around the tree to slope slightly towards it. The final shovelful of soil should be spread around the tree without firming it, in order to make a dust blanket which will prevent evaporation. The pruning of the tops may be left until the orchard is planted, but it should be done as soon thereafter as possible.

THE MULCH AND THE CLEAN CULTURE SYSTEMS.

These two systems have their ardent advocates, and much fiery discussion has been indulged in by their champions. The clean

culture exponents have been rather more numerous, and in a general way have had the better of the argument; on the other hand, the contention of many of them that orcharding under the mulch system cannot be made successful has been refuted in many cases by the development of splendid mulch system orchards.

The consensus of opinion to-day is that the mulch system should be used only under specially favorable conditions of soil, or where cultivation is impossible. The following summary from a carefully conducted experiment at the New York Experiment Station will show, graphically, the results in orchards conducted under the two systems:

Mulched.		*Cultivated.*
434	Fruits per barrel	309
2.8	Barrels per tree	4.2
$71.52	Net profit per acre	$110.43
1.1	Gain in tree diameter	2.1

MULCH SYSTEM.

Under this system the trees are fertilized as thoroughly as under the clean culture system. The grass, weeds, and whatever else may grow on the ground is cut from time to time and piled up around the trees, or, in older orchards, left where it falls. When the trees occupy the land so that this mulch is not sufficient, additional material from some other source must be hauled in to cover the ground. It is necessary to have sufficient mulch to keep weeds, and finally, grass, from growing in the orchard.

The advocates of this system claim that it is much cheaper than the clean culture system, that the trees resist drought better, that the fruit ripens earlier, colors better, and keeps longer than fruit from the cultivated orchards. Objections to it are: smaller returns, danger from fire, roots too near the surface of ground and hence greater injury from droughts, and greater difficulty in controlling insect and fungous enemies.

CLEAN CULTURE SYSTEM.

This, as generally understood, consists in clean cultivation in the spring and early summer, and the cessation of the cultivation and the sowing of a cover crop in July. This cover crop is plowed or disked under the following spring and the cultivation resumed.

It is claimed for the clean culture system that it produces ideal conditions for the growth of the trees by preserving moisture; improving condition of the soil; unlocking soil fertility; preventing the roots from coming too near the surface, where they will be injured by drought or frost; and by giving an opportunity for the addition of fertility to the soil through the cover crop. It is also claimed that better control of the bearing of the orchard can be secured, obviating to some extent

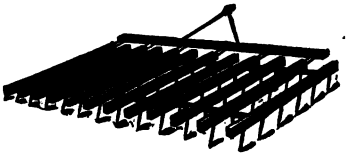

FIG. 6. Smoothing Harrow.

the alternation of bearing years and years in which the orchard does not produce a paying crop.

A sort of compromise between the clean culture and the mulch system is practiced by some with what they claim to be good success. This consists in permitting trees to stand in a strip of sod, but cultivating the open spaces between the rows in one direction. This is claimed to give the good results of both systems, but the principal argument in its favor is that it can be used on very hilly land where the soil would otherwise wash badly. See Plate VI.

IMPLEMENTS USED IN CULTIVATION.

Ordinary plows, harrows and cultivators, form effective implements for cultivating orchards, but certain modifications of them have been made to facilitate the cultivation of the modern low-

headed trees. One of the important points to be remembered is that every effort should be made to prevent injury to the trees from the implements used. With this purpose in view, a harness like that

FIG. 7. Clark's Double Cutaway Disk Harrow.

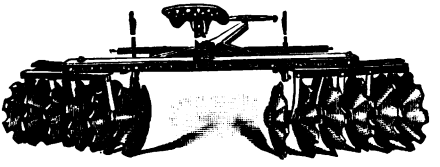

FIG. 8. Clark's cutaway harrow extended for cultivating under trees.

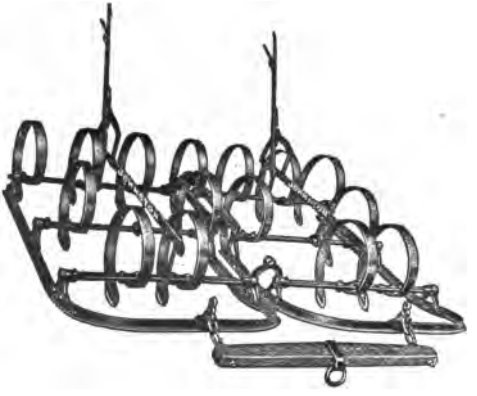

FIG. 9. Spring Tooth Harrow.

shown in Fig. 5 is recommended because it obviates the use of whiffletrees, which are fruitful sources of barked and otherwise injured trees. When the trees have attained their growth it is sometimes difficult

PLATE VI. Cultivated strips between rows of trees. After R. I. Exp. Station.

to cultivate with the ordinary harrows, and extensions such as illustrated in Fig. 8 are employed.* It should be remembered, however, that after the trees have attained a growth sufficient to compel the use of such implements it is not necessary to cultivate the ground close to the trunks of the trees, because no feeding roots are found there, and weeds if present have but little chance to grow.

The principal implements are the smoothing harrow, Fig. 6; the disk harrow, which can be used in disking under cover crops or working the soil deeply when a plow is not desirable, Figs. 7 and 8; the spring-tooth harrow, Fig. 9, an effective implement among rocks;

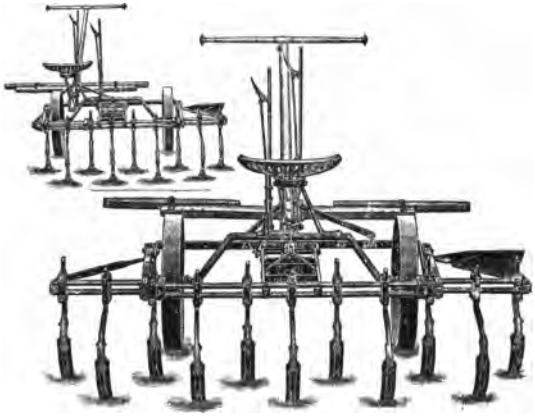

FIG. 10. Orchard Cultivator.

and the cultivator, illustrated in Fig. 10. These, in addition to a serviceable plow, are the only implements required by an orchardist at any time in connection with the cultivation of his orchard.

COVER CROPS.

In the clean culture system cover crops form an important part. At one time cultivation was supposed to furnish a solution of most of the vexatious problems relating to soil fertility. Cultivation is useful in putting the soil into good condition and aids in unlocking soil fertility. Acting on these principles, some orchardists, a few years ago, practiced a system of persistent and "merciless" cultivation.

*See also Plate IX, Fig. 1.

The work was overdone, and the results soon indicated that something was wrong. The soil refused to respond to cultivation or to fertilizers, owing to the lack of humus, and the fall and winter rains washed it badly. For the purpose of remedying the difficulties, the use of a cover crop was introduced.

The beneficial results of a cover crop may be enumerated as follows: When plowed under it adds humus to the soil; it takes up and holds certain forms of plant food which might otherwise leach away; it aids in putting the soil in good physical condition; it makes a covering for the ground and prevents washing away of the good, surface soil; it covers the ground and protects the roots of the trees, to some extent, from hard winter frosts; it catches and holds snow and rain until they have a chance to soak into the ground; and when leguminous crops are used, nitrogen is added to the soil.

Most of these statements are self-evident. It may be interesting to note how much nitrogen may be gained for the soil through the use of the nitrogen-gathering legumes, and the following tables are, therefore, appended:

* Pounds of Fertilizing Constituents Produced on One Acre Each of Hairy Vetch and Cowpea by Growth of Three Months.

Ithaca, N. Y., 1901.

	Amount air-dried substance. Lbs.	Nitrogen. Lbs.	Phosphoric acid. Lbs.	Potash. Lbs.
Vetch—				
Vines and leaves	6,824	240.2	52.9	51.9
Roots	567	15.9	3.5	3.1
Total	7,391	256.1	56.4	55.0
Cowpea—				
Vines and leaves	2,622	46.3	22.8	19.0
Roots	454	6.3	2.8	2.0
Total	3,076	52.6	25.6	21.0

* Cornell Bul. No. 198, p. 108.

FIG. 1. Rye Cover Crop.

FIG. 2. Nature's plows—rocks no obstacle.

PLATE VII.

* Green Product which may be Produced in Growing a Cover Crop from July to October, and the Amount of Certain Fertilizing Constituents Per Acre.

Ottawa, Canada, 1896.

Seed sown, July 13. Cut, October 20.	Weight of crop per acre (green).		Organic matter.	Ash.	Nitrogen.
	Tons.	Lbs.	Lbs.	Lbs.	Lbs.
Alfalfa—					
Stem and leaves	5	1,192	2,664	510	75
Roots	5	558	3,120	613	61
Total	10	1,750	5,784	1,123	136
Mammoth Red—					
Stem and leaves	6	1,310	2,269	508	82
Roots	3	1,260	1,409	219	48
Total	9	2.570	3,678	727	130
Crimson—					
Stem and leaves	11	234	2,093	602	85
Roots	3	201	2,801	190	19
Total	14	435	4,894	792	104
Common Red—					
Stem and leaves	4	1,779	1,842	481	70
Roots	2	1,445	1,394	172	17
Total	6	3,224	3,236	653	87

*Cornell Bul. No. 198, p. 107.

* YIELD OF GREEN FORAGE PER ACRE, AND FERTILIZING INGREDIENTS IN CROPS AND ROOTS IN CERTAIN LEGUMES.

CROP.	Green crop. Tons.	NITROGEN.			POTASH.			PHOSPHORIC ACID.		
		Crop. Lbs.	Roots. Lbs.	Total plant.	Crop. Lbs.	Roots. Lbs.	Total plant.	Crop. Lbs.	Roots. Lbs.	Total plant.
Soy Bean, seeds nearly grown..	9.5	165	9	174	109	6	115	42	2	44
Cowpea vines.....	8.0	67	23	90	60	15	75	17	6	23
Vetch, in bloom....	12.0	153	27	180	163	22	185	37	7	44
Red Clover, full bloom.....	13.0	138	44	152	152	32	184	32	13	45

*R. I. Bul. No. 92, p. 122.

Cover crops are usually sown about the middle of July and allowed to remain on the ground until the following spring, when they are plowed under.

Buckwheat is one of the best among the non-leguminous crops. This can be sown as late as the last of July and still produce a good cover crop before the coming on of winter. Winter rye is also used to some extent, but is less desirable. Among the legumes, red clover is perhaps the best-known in this State. This will make a fair growth by fall, but will live over winter, so that it is more difficult to subdue in the spring than crimson clover, which has recently been introduced. Mammoth clover is also used and considered satisfactory by a great many orchardists. Crimson clover makes a good, vigorous growth during the latter part of the summer and adds, as may be seen from the table, a good supply of nitrogen to the soil. The vetches are highly recommended by some growers on account of the perfect mat or covering which they produce. Spring vetch, (*Vicia sativa*), winter vetch (*Lathyrus hirsutus*), and hairy vetch (*Vicia villosa*) are the varieties used. The winter vetch and hairy vetch especially form a very close-growing mat, and cover the soil admirably. The principal objection to the use of these is the high price of the seed.

All the above-named crops may be sown broadcast, or, what it perhaps a little better, drilled in, if the spread of the trees permits.

PLATE VIII. Orchard in Bloom. From Premium List N. E. Fruit Show.

The amount of seed per acre is indicated in a table given at the close of this discussion.

In recent years, cowpeas and soy beans have also been recommended, and, so far as experience with these two crops in this State indicates, they are valuable additions to our nitrogen-gathering plants. The earlier varieties of the soy bean will ripen so that seed can be gathered, and for that reason perhaps it may be preferred to the cowpea. The latter, however, is more likely to succeed on an acid soil, makes a more rapid growth, and produces a very good covering for the ground. Seed of these two plants may be sown broadcast, but should preferably be drilled in and then cultivated while plants are small.

The following quantities of seed per acre are recommended for the various cover crops:

Crimson clover	15 lbs.
Mammoth clover	12 "
Red clover	12 "
Cowpea	1½–2 bushels.
Soy bean	1½–2 "
Summer vetch	1½ "
Winter vetch	1 "
Buckwheat	1 "
Rye	1½ "

CROSS-POLLINATION.

The cross-pollination of apples is imperfectly understood. A little work has been done, sufficient to indicate that there is a large field for study, but as yet not enough has been accomplished to give us very much definite knowledge. The most extensive experiments in this line have been conducted at the Oregon Experiment Station, and some of the conclusions will be noted here. It must be remembered, however, that conditions of soil and climate affect the behavior of fruit at the blossoming period to a very large extent, and it would therefore require a great amount of work to determine definitely the fundamental principles for any one place, and finally, the problems must be studied under the different conditions in the different sections of the country. For instance, a variety may produce a

small amount of pollen one season and an abundance the next. A variety may, apparently, be self-sterile in one part of the country, and self-fertile in another.

From the work already done, as recorded in Bulletin 104, by Lewis and Vincent, of the Oregon Experiment Station, the following abstracts are appended: Out of 87 varieties of apples experimented with, 59 varieties were found to be self-sterile, 15 self-fertile, and 13 partially self-fertile. The following varieties which are found to a greater or less extent in the East are enumerated in the experiment:

Self-Fertile.	*Partially Self-Fertile.*	*Self-Sterile.*
Baldwin,	Ben Davis,	Bellflower (Yellow),
Bailey Sweet,	Canada Red,	Early Strawberry,
Grimes Golden,	Mann,	Fallawater,
Keswick Codlin,	Rambo,	Gravenstein,
Oldenburg (Duchess of),	Stark,	Gano,
Pumpkin Russet,	Spitzenburg,	Haas,
	Wagener,	Jonathan,
	Whitney Crab,	Tompkins King.
	Yellow Transparent,	Limbertwig,
		McMahon White,
		Maiden Blush,
		Pewaukee,
		Rome Beauty,
		Ralls,
		R. I. Greening,
		Sweet Bough,
		Saint Lawrence,
		Summer Pearmain,
		Tolman Sweet,
		Transcendent Crab,
		Twenty Ounce,
		Wealthy,
		Winesap,
		York Imperial.

Many varieties of apples naturally tend to be self-sterile. Indications are that cross-pollination is the rule rather than the exception.

Many self-fertile varieties produce larger and more uniform fruit when cross-fertilized than when self-fertilized. Results seem to indicate that there is a mutual affinity between different varieties. Better results are secured in one variety by the application of pollen from certain other varieties. For instance, in an experiment with pollination of the Spitzenburg, when self-fertilized, it produced with a certain number of pollinations 100 grams of fruit and 13 seeds; when pollinated with the Newtown, 126 grams of fruit and 65 seeds; with the Arkansas Black, 128 grams of fruit and 68 seeds; with Jonathan, 144 grams of fruit and 70 seeds; and with the Baldwin, 157 grams of fruit and 71 seeds.

There were some indications of the immediate effect of pollen on the color of the fruit. Older observations that imperfect pollination and consequent imperfect development of the seed tendered to reduce the size or produce unsymmetrical fruit were confirmed. Some of the self-fertile varieties when self-pollinated were found to be seedless or devoid of plump seeds. Cross-pollination increased the size of the fruit in self-fertile varieties. See Plate IX, Fig. 2.

There is a great deal of difference in the amount of pollen produced by the different varieties, but varieties which produce a small amount of pollen are not, necessarily, the self-sterile ones. Pollen is transferred largely by insects and only slightly by the wind. The time of blossoming for different varieties varies, and in planning for interpollination, account must be taken of this fact. The average length of time in which the apples remained in blossom at the Oregon Station was 13 days, and, when kept from fermenting, the gathered pollen retained its viability for three weeks.

The time of blossoming is of importance in considering the selection of varieties with the view of securing proper interpollination, and the following tables from the reports of the Rhode Island Experiment Station, while not extensive enough or covering a sufficiently large number of seasons, are of considerable value. The observations recorded were made in the orchard of the Rhode Island State College at Kingston.

* Blooming Period.

Variety.	First.				Full.				Fallen.			
	1899.	1901.	1902.	1903.	1899.	1901.	1902.	1903.	1899.	1901.	1902.	1903.
Alexander	.....	May 25.	May 18.	May 11.	.....	May 30.	May 21.	May 16.	.....	June 8.	May 25.	May 21.
Baldwin	.....	" 24.	" 14.	" 11.	.....	" 28.	" 21.	" 16.	.....	" 5.	" 26.	" 22.
Ben Davis	May 15.	" 23.	" 13.	" 16.	May 22.	" 27.	" 20.	" 19.	May 29.	" 8.	" 26.	" 23.
Early Harvest	" 15.	" 21.	" 11.	" 8.	" 22.	" 25.	" 20.	" 15.	" 29.	" 4.	" 27.	" 21.
Early Strawberry	.....	.....	.....	" 9.	.....	.....	.....	" 15.	.....	.....	.....	" 19.
Fallawater	May 15.	May 24.	May 13.	" 9.	May 25.	May 30.	May 22.	" 15.	May 30.	June 7.	May 29.	" 20.
Golden Russet	.....	" 23.	" 10.	" 9.	.....	" 27.	" 16.	" 15.	.....	" 3.	" 23.	" 20.
Grimes Golden	May 16.	" 23.	" 12.	" 11.	May 22.	" 27.	" 18.	" 15.	May 27.	" 5.	" 24.	" 21.
Hubbardston	" 15.	" 24.	" 14.	" 11.	" 25.	" 27.	" 21.	" 16.	" 31.	" 3.	" 31.	" 22.
Northern Spy	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Northwestern Greening	.....	May 28.	.....	May 13.	.....	.....	.....	May 16.	.....	.....	.....	May 21.
Peck Pleasant	May 15.	" 24.	May 17.	" 13.	May 24.	May 31.	May 22.	" 18.	May 27.	June 4.	May 26.	" 22.
Pewaukee	" 15.	" 21.	" 10.	" 9.	" 22.	" 25.	" 18.	" 14.	" 29.	" 3.	" 26.	" 20.
Primate	" 12.	" 20.	" 8.	" 8.	" 19.	" 24.	" 17.	" 14.	" 26.	" 3.	" 23.	" 20.
Pumpkin Sweet	.....	" 23.	" 16.	" 9.	.....	" 25.	" 20.	" 14.	.....	" 1.	" 25.	" 21.
Red Astrachan	May 13.	" 21.	" 11.	" 8.	May 19.	" 23.	" 16.	" 14.	May 25.	" 1.	" 22.	" 18.
Rhode Island Greening	" 15.	.....	" 11.	" 8.	" 22.	.....	" 18.	" 13.	" 29.	.....	" 27.	" 20.
Roxbury Russet	" 16.	May 23.	" 11.	" 7.	" 28.	May 26.	" 18.	" 12.	June 2.	June 8.	" 27.	" 20.
Tolman Sweet	.....	" 24.	.....	.....	.....	" 27.	.....	.....	.....	" 5.	.....	.....
Tompkins King	.....	.....	May 12.	May 13.	.....	.....	May 18.	May 16.	.....	.....	May 24.	May 22.
Twenty Ounce	May 15.	May 23.	" 11.	" 9.	May 22.	May 27.	" 18.	" 16.	May 26.	June 3.	" 24.	" 22.
Wagener	" 13.	.....	" 11.	" 9.	" 20.	.....	" 18.	" 15.	" 27.	.....	" 25.	" 20.
Wealthy	.....	May 23.	" 14.	.....	.....	May 25.	" 20.	.....	.....	June 3.	" 29.	.....
Williams	May 19.	" 24.	" 18.	May 10.	May 28.	June 3.	" 28.	May 18.	June 4.	" 10.	June 3.	May 22.
Yellow Bellflower	" 16.	" 23.	" 12.	" 9.	" 27.	May 28.	" 20.	" 15.	May 27.	" 5.	May 25.	" 22.
Yellow Transparent	" 15.	" 23.	" 13.	" 10.	" 24.	" 27.	" 20.	" 15.	" 29.	" 3.	" 28.	" 20.
York Imperial	" 17.	" 24.	" 17.	" 13.	" 27.	June 1.	" 22.	" 18.	" 31.	" 8.	" 29.	" 22.

* From Annual Report of the R. I. Exp. Station for 1903.

FIG. 1. Use of extended disk harrow in orchard. See p. 125.

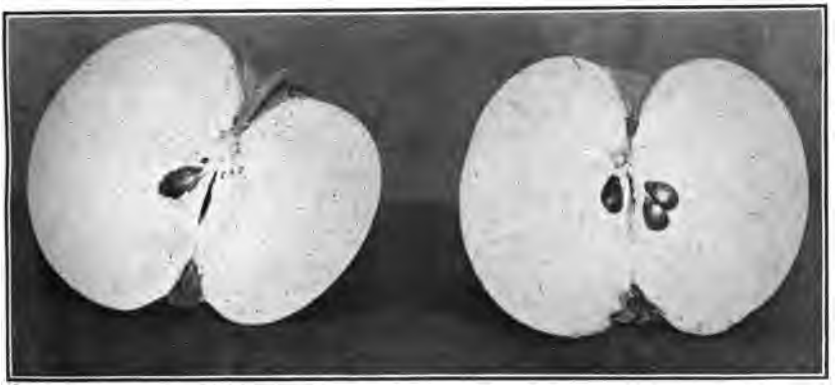

FIG. 2. Unsymmetrical and partially seedless fruit, due to deficient pollination, at the left. Perfect fruit, the result of complete pollination, at the right. *After Burton N. Gates.*

PLATE IX.

* Blooming Period.

	Opening of Leaf-buds.			First Bloom.			Full Bloom.		
	1904.	1905.	1907.	1904.	1905.	1907.	1904.	1905.	1907.
Baldwin	May 4	.....	May 1	.....	May 17	May 20	.....	.....	June 3.
Ben Davis	May 4	May 4	.....	May 17	May 18	.....	May 21	May 25	.....
Early Harvest	May 4	.....	May 6	May 13	.....	May 20	May 20	.....	June 3.
Northern Spy	May 10	.....	May 9	May 20	.....	May 25	.....	.....	June 3.
Red Astrachan	May 4	May 2	May 1	May 15	May 17	May 19	May 20	May 25	May 23.
Roxbury (russet)	May 2	May 3	May 6	May 14	May 16	May 20	May 19	May 22	June 5.
Winesap	May 5	.....	May 6	May 18	.....	May 29	May 24	.....	June 4.
Yellow Transparent	May 4	.....	May 10	May 14	.....	No bloom	May 19	.....	.....

* From Report of the R. I. Exp. Station, 1907.

BEES AS AGENTS IN CROSS-POLLINATION.

It will be noted in the account of the Oregon work, that Lewis and Vincent found insects to be the chief carriers of pollen, and some

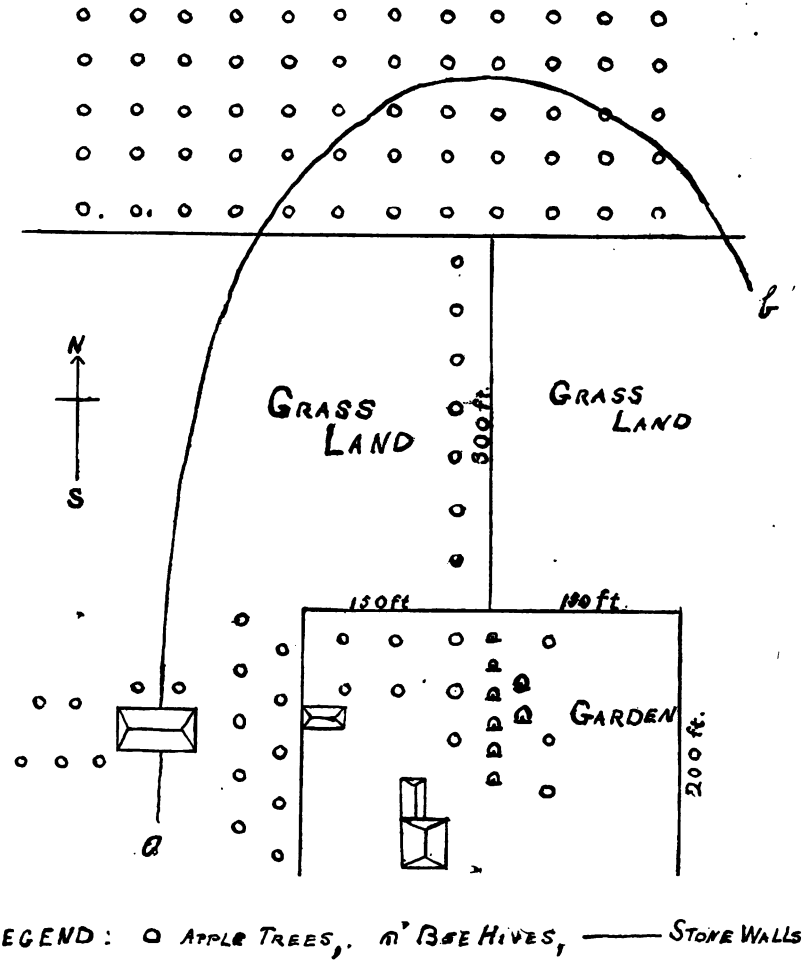

FIG. 11. Pollination of apple trees by bees. The line *a b* shows the boundary of territory reached by bees from hives in the garden, as indicated by the setting of fruit. After Gates and Miller.

observations made in this State by Arthur Miller of Providence, confirm this opinion and emphasize the great value of bees as agents in transferring pollen.

The observations were made on a farm at Barrington on which bees were kept. The sketch, Fig. 11, shows the location of buildings, the hives and nearby orchards and grass lands. During the spring when the observations were made there was a good deal of rain, and the bees never worked very far from the hives. In the fall of the year the limit of their work was plainly seen in the amount of the fruit on the trees. The curved line (a b) marks the approximate boundary of the territory covered, and inside of this the trees were well set with fruit, while outside the trees bore only a partial crop or none at all.

Numerous other observations on the beneficial results following the introduction of bees in orchards have been made in this and other states, but the above illustrates the matter quite clearly and will be sufficient to indicate that orchardists will do well to consider quite seriously the use of bees in their orchards.

PRUNING.

Perhaps no operation in orcharding is so difficult to give definite directions in regard to as pruning. About all that can be done is to enumerate the principles involved, the benefits which result, and to

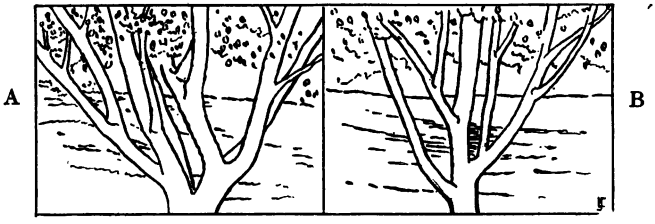

FIG. 12. Scaffold branches well arranged at right, poorly placed at the left.

FIG 13. Hand Pruning Shears.

give a few general directions. The rest must be left to the common sense and judgment of the grower.

The purposes of pruning are to shape the tree, prevent an excess of wood growth and too great competition between the branches of the tree, open it up to air and sunlight, and to encourage the formation of fruit buds.

Pruning to shape the tree should begin in the nursery, or at least with the first year of planting in the orchard. As has been discussed already, it is usually best to plant one-year-old trees, since the head can be best shaped on trees of this age. The main stem should be headed back, and four or five principal branches should be permitted to grow. These should not be allowed to start at the same level on the trunk, as illustrated in Fig. 12A, but should begin at 20 or 25 inches above the ground, and should end at about 45 or 50 inches. Fig. 12B.

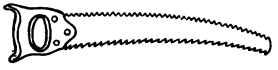

FIG. 14. Pruning Saw.

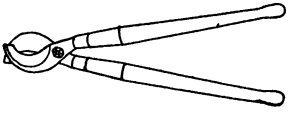

FIG. 15. Long-handled Pruner.

Subsequent pruning depends upon the vigor of the trees and various other circumstances. Some believe in continually heading back the trees from the very beginning and permitting only a very few branches to grow. Care must be taken at all times not to permit too many branches to start into growth. This can be done by rubbing off the superfluous ones in early summer. Under certain circumstances growth may be checked by bending over and partially breaking the too ambitious branches. One grower believes in letting the trees take care of themselves very largely at the outset, pruning out only the interfering branches, on the principle that they need all the leaf surface that they can possibly produce. Another omits his early pruning because the deer in most cases keep his trees headed back more than sufficiently. He says that when they get through he will finish the job on such trees as are worth keeping.

Another essential point in shaping the tree is to keep it as near the ground as possible. The old-fashioned, high-headed trees have been discovered to be very expensive to handle, and they are no longer recommended. Powell says that it costs three times as much to pick the apples from a high tree as it does from a low tree.

The rest of the pruning should be aimed almost entirely at preventing too great a wood growth, and maintaining the form of the tree. In order to attain the first of these objects, summer pruning may be resorted to with good results, since cutting back the branches of the tree at the time when the fruit buds are forming during the last part of June, tends to throw the strength and vitality of the tree into the formation of the buds.

Trees of upright habits like Sutton, Wealthy, and Maiden Blush, may be encouraged to spread out by pruning to outside buds, and the spreading varieties, such as the Roxbury Russet, may be encouraged to a more compact form by pruning to inside buds.

Eternal vigilance should be exercised by owners of trees, fruit as well as shade, to see that pruners do not leave long stumps which it is difficult for the tree to heal over and which later give opportunity for organisms causing decay to enter the heartwood. Cover all wounds over two inches in diameter with good white lead paint.

TIME TO PRUNE. TOOLS.

An old saying is "Prune when you have the time and a sharp ax." We may accept this rule in part at the present time, but with the addition of an emphatic clause, *but don't use the ax.*

For general pruning the early spring is perhaps the best, but any time during the winter and even in the fall, if time permits, will do quite well. If it is desired to check wood growth and promote the formation of fruit buds, summer pruning, as already mentioned, should be employed.

The essential tools are hand shears, such as pictured in Fig. 13, and a pruning saw, Fig. 14. In addition, a pair of long-handled pruners, Fig. 15, and a pole pruner, Fig. 16, are sometimes convenient.

Scraping of old trees is sometimes advisable, especially if they have been neglected for some time, or are badly infested with the San

FIG. 16. Pole Pruner.

FIG. 17. Tree Scraper.

Jose scale and the codling moth. For light work, an onion hoe, the handle of which has been cut to a length of about 2½ or 3 feet, will serve the purpose quite well. For heavier work when trees are bark-bound, and when it is advisable to cut entirely through the old, dead bark, a stronger scraper, such as that shown in Fig. 17, must be used.

THINNING.

Peach and plum growers have practiced thinning of the fruit for some years past, but recently apple growers also have begun to take it up, and in the best apple-growing sections the process is now the rule rather than the exception.

The advantages of thinning are, briefly, as follows: Larger and more uniform fruit is secured. This is advantageous in two ways: The seeds take up a comparatively large amount of plant food, and there is, therefore, a greater drain on the tree for seeds in a bushel of small fruit than in a bushel of large fruit. A bushel of large fruit brings a better price than a bushel of small fruit in spite of the fact that it contains comparatively less substance and more air.

It gives an opportunity to remove and destroy wormy fruit early in the season, and therefore helps to check fruit pests.

It saves in the time consumed in picking and grading.

It serves to promote annual and regular bearing.

No specific rules for thinning can be given. In general, fruits should not be allowed to touch. Further than that the amount of thinning depends on the size and vigor of the tree, the variety, and the regularity with the fruit is set all over the tree, and must be left entirely to the judgment of the orchardist.

ORCHARD FERTILIZATION.

Some fruit growers seem to manage their orchards on the supposition that since our improved varieties of orchard fruits are propagated by grafting, the resulting fruit should be in the nature of a "graft," or something for nothing. It has been expected that orchards should yield hay or pasturage the same as other land, and in addition, a crop of fruit, or in other words, a double crop, with no better treatment for the land than would be required for one crop.

The practices of our better fruit growers and recent investigations have indicated that no crop responds more fully to generous treatment, and especially to the addition of proper plant food. Furthermore, it stands to reason that orchards have special need of plant food, since an orchard crop is a continuous one and the ground cannot be rested or improved through crop rotation. If we compare the amount of plant food removed by an orchard crop in wood growth, leaves, and fruit, we shall find that there is a more nearly continuous and a greater drain upon soil fertility than in most other crops. The following table will present this matter quite graphically:

*Fertilizing Elements used by Apples and Farm Crops.

	PRODUCE.		POUNDS.		
Kind.		*Amount.*	*Nitrogen.*	*Phosphorous.*	*Potassium.*
Oats.....	Grain..	75 bushels.....	45	7	9
	Straw..	2 tons.....	24	4	40
Total crop.....			69	11	49

*Bul. 101 Ore. Exp. Sta

PRODUCE.		POUNDS.		
Kind.	*Amount.*	*Nitrogen.*	*Phosphorous.*	*Potassium.*
Wheat... Grain..	40 bushels.....	46	6	11
Wheat... Straw..	2 tons.....	19	4	34
Total crop.....		65	10	45
Timothy.....	2 tons.....	48	6	47
Potatoes.....	300 bushels.....	63	13	90
Apples... Fruit...	600 bushels.....	47	2	57
Apples... Leaves.	4 tons.....	59	7	47
Apples... Wood growth.....		6	2	5
Total.....		112	11	109

Cornell Experiment Station Bulletin Number 103 puts the same fact in a somewhat different way in the following table, which shows the amount of plant food in fruit and leaves removed from an acre of 35 trees in twenty crops, with an estimated yield of 15 bushels apples per tree, and in 20 years' continuous cropping with wheat, assuming an average yield of 15 bushels wheat and 35 pounds of straw per acre.

Plant Food Removed in 20 Years of Cropping. (Round Numbers).

Apples:

Fruit and leaves:

1,337 pounds nitrogen.
310 pounds phosphoric acid.
1,895 pounds potash.

Wheat:

Grain and straw:

660 pounds nitrogen.
211 pounds phosphoric acid.
324 pounds potash.

This comparison shows that 20 crops of apples remove more than twice as much nitrogen, one and one-half times as much phosphoric acid, and nearly three times as much potash as the same number of crops of wheat.

*Another calculation by Professor Roberts gives the amount of plant food required by an acre of apple trees for a period of 20 years, between the ages of 13 and 33 years as follows:

	Fruit.	*Leaves.*	*Value.*
Nitrogen	498.60 lbs.	456.75 lbs.	$143 30
Phosphoric acid	38.25 lbs.	126.00 lbs.	11 50
Potash	728.55 lbs.	441.00 lbs.	52 63
Totals	1,265.40 lbs.	1,023.75 lbs.	$207 43

A comparison with the amount removed by 20 crops of wheat, as given by another table, may be of interest in this connection:

	Grain.	*Straw.*	*Value.*
Nitrogen	424.80 lbs.	234.78 lbs.	$98 94
Phosphoric acid	160.20 lbs.	50.40 lbs.	14 74
Potash	109.80 lbs.	214.20 lbs.	14 58
Totals	694.80 lbs.	499.38 lbs.	$128 26

*Another calculation given by Professor Bailey shows that 5 bushels of apples remove 11 pounds of nitrogen, nearly 1 pound of phosphoric acid, and 16 pounds of potash; and that the leaves of a tree large enough to produce these apples would contain 10 pounds of nitrogen, 3 pounds of phosphoric acid, and 10 pounds of potash; or a total of 21 pounds of nitrogen, nearly 4 pounds of phosphoric acid, and 26 pounds of potash.

Thirty-eight elements enter into the composition of a plant, and ten of these are essential to its proper growth; namely, carbon, oxygen, hydrogen, nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, and iron. Most of these are found in sufficient quantity in the soil, and the grower is generally required to consider only the three most important ones: namely, nitrogen, phosphorous, and potassium.

Nitrogen is essential for a vigorous wood and leaf growth of the tree; phosphorous, for a proper ripening of the plant and fruit; and potassium forms a large part of the ash of the wood and of the fruit

* Principles of Fruit Growing, by L. H. Bailey.

and is the base of the fruit acid. It also has a physiological function in aiding the development of the proper color.

These statements indicate to us that the application of fertilizers should vary with the different periods of tree development. Young trees, which must produce wood and leaf growth, require comparatively more nitrogen than bearing trees. On the other hand, when the trees begin to produce fruit, potassium and phosphorous are more essential.

Barnyard manures are used quite extensively in many sections for fertilizing orchards, and may, during the early growth of the trees, be used without the addition of other ingredients. For bearing orchards, barnyard manure should be used in comparatively small quantities, and should be supplemented by a liberal application of potash and phosphoric acid.

It is impossible to give definite advice regarding fertilizers for all kinds of soil. The poorer soils, of course, need a greater amount of all the three ingredients, but especially of nitrogen, than do better soils. Dr. Voorhees recommends a basic formula made up of equal parts of muriate of potash, acid phosphate, and fine ground bone, with the addition of nitrogen, either through barnyard manure or nitrate fertilizers, or through leguminous cover crops. Nitrogen is required primarily during the early part of the growing season and should, therefore, if applied in barnyard manure, be put on the soil in the fall or winter, and if in chemical fertilizers, in the early spring. In order to bring the fertilizer into that part of the soil where the roots are and should be kept, all fertilizers should be plowed under.

The trees themselves are the only real index to the amount of fertilizer to be applied. Enough nitrogen should be used to produce a good, vigorous foliage and growth, and sufficient of the other ingredients should be added to develop a good crop. The amount must, therefore, vary with the age of the trees. When trees are first planted, many orchardists apply a small quantity of fertilizer around each tree. Professor Sears recommends a formula consisting of 1 ounce nitrate of soda, $\frac{3}{4}$ pound high grade sulfate of potash, and $\frac{3}{4}$ pound basic slag, or acid phosphate per tree, for each year.

Fig. 1. Nozzles and other accessories.

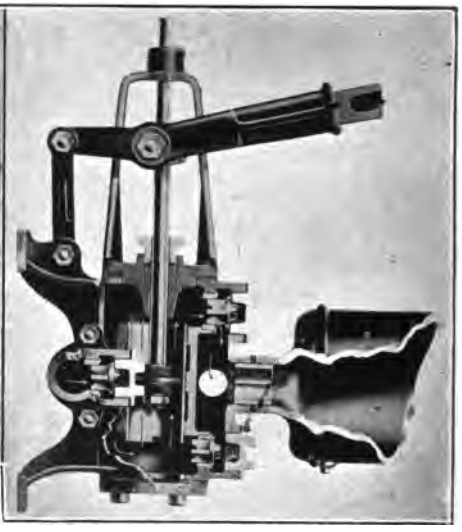

Fig. 2. Tank Pump.

Fig. 3. Barrel Pump.

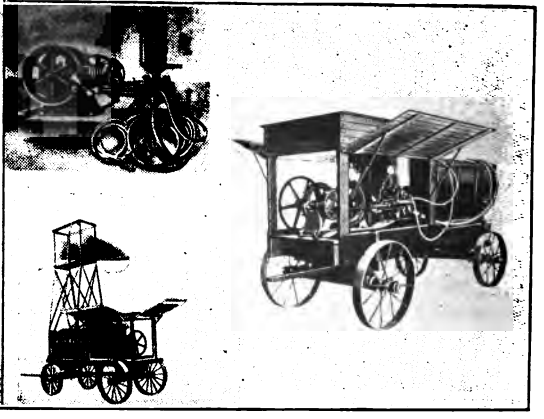

Fig. 4. Power Sprayers.

Plate X. Spraying Apparatus.

For bearing orchards, he would use 500 pounds basic slag, or acid phosphate, and 300 pounds high grade sulphate of potash per acre. J. H. Hale uses for bearing orchards 1,000 pounds of bone, and 400 pounds of muriate of potash. Professor Voorhees would use for a bearing orchard, 1,200 pounds of the basic slag fertilizer already recommended; and Dr. L. L. Van Slyke, Geneva Experiment Station, recommends the following formula:

Cotton seed meal	100 lbs.
Raw ground bone	100 lbs.
Acid phosphate	100 lbs.
Muriate of potash	100 lbs.

Professor Maynard recommends a formula consisting of 250 to 500 pounds of fine ground bone, 100 to 300 pounds of sulfate of potash, and 50 to 150 pounds of nitrate of soda.

In the western part of New York, especially in the neighborhood of Buffalo, orchardists are making heavy applications of barnyard manure and claim that excellent results are secured.

It is evident from these statements that no two orchardists are agreed on any one formula or any given quantity of fertilizer. It must vary with the soil and other conditions under which the grower is working.

Fruit trees do best on limestone soil, and since Rhode Island soils are generally lacking in lime, the addition of this element in some form is nearly always followed by beneficial results. Lime may be added in the form of unleached hardwood ashes, at the rate of from 1 to 2 tons per acre; or ground lime, air-slaked lime, or quick lime, at the rate of from ½ to 2 tons per acre. Of course, if ashes are used, part or all of the potash required is furnished at the same time, and the regulation potash application may be reduced or omitted altogether.

INSECTS, PLANT DISEASES, AND SPRAYING.

Older orchardists often tell us that successful growing of fruit is impossible at the present time, owing to the great increase in the

number of enemies with which the fruit grower has to contend. It is undoubtedly true that we now have a greater number of enemies than were present in the early days of fruit growing in this country, since we have received a great number of fruit pests from foreign countries. It is also true that, in the eyes of many, the difficulties to be contended with are magnified on account of the fact that we are always inclined to view the past in a somewhat roseate hue, and on account of the fact that the standard to which the fruit grower must attain has been raised. Fruit could formerly be quite readily sold, even if it did have a few wormholes or the marks of the apple scab and other plant diseases. At the present time, first-class fruit must be practically free from all such blemishes. It is a comforting fact in connection with these conditions that at no time in the past have we had such a thorough knowledge of the means of combating these pests, or such efficient apparatus. The up-to-date fruit grower fears his insect and plant-disease enemies less to-day than he did half a century ago. A man thoroughly conversant with the subject of spraying has the fruit-growing situation pretty thoroughly in hand so far as most of his enemies are concerned.

At the outset, let us enumerate some of the most important principles to be kept in mind: 1. Learn to know the insect or plant disease so as to be able to attack it at the most vulnerable point in its life history, and in the most economical manner. 2. Get a thorough knowledge of the different spray remedies and their preparation and use. 3. Secure efficient, up-to-date apparatus. 4. See to it that the work is thoroughly done.

In this bulletin we cannot enter into details regarding all the various insects and diseases and their remedies. Only a few suggestions can be given in regard to the more common ones, and the reader is advised to consult books and bulletins on plant diseases and insects and on spraying for detailed accounts.

Among general rules for combating his insect pests the reader should bear in mind the following: Buy good stock and see to it that it is free from plant pests by insisting upon its being inspected by official

inspectors and by a personal examination. Give the pests as little chance as possible by destroying all breeding places, such as volunteer, neglected trees, rubbish which may harbor insects over winter, and secondary hosts which may help propagate injurious insects and plant diseases. Keep trees healthy and vigorous. Prevent decay or the entrance of disease into the trunk or branches of the tree by intelligent pruning, and by protecting the exposed surfaces. If decay does start, clean out, disinfect, and fill the holes. Spray thoroughly. Gather and destroy all injured or diseased fruit from the tree and from the ground.

INSECTS INJURIOUS TO APPLES.

*Borers.** Three kinds of borers affect apples: the round-headed, the flat-headed, and the fruit-tree bark-beetle, or shot-hole borer. The round-headed and flat-headed borers generally attack the lower part of the trunk. Some growers claim that they secure a greater or less immunity from the attacks of these pests by various washes which may be applied to the trunk of the tree. The majority, however, say that the old-fashioned way of destroying the insects by inserting a flexible wire into their holes, or by digging them out with a sharp knife, are the only practical methods.

The shot-hole borer usually works in the branches of the tree. So far as observed, this has not done a great deal of damage to the apple trees in this State. In any event, this insect is injurious only when a tree is greatly reduced in vitality from some other cause, and the remedy is to increase the vigor of the tree.

Scale Insects. Three scale insects commonly occur in our apple orchards. The scurfy scale is found in almost every orchard, but seldom in very large numbers. The oyster-shell scale,† or bark-louse as it is sometimes called, is much more prevalent, and occasionally becomes so numerous as to destroy a tree. Generally, however, this scale, in common with the scurfy scale, is kept in check by efficient parasites. From a study of the life history of these scales, we find that the females lay eggs under the scale covering in the fall of the

*See Plate XIII, Fig. 1. †See Plate XII.

year and subsequently die. The eggs live over winter and hatch the following season about the last part of May or the first of June. At this time the little larvæ crawl about unprotected over the tree looking for a place to settle down. This is the point at which they should be attacked. The little larvæ may be readily destroyed by almost any contact insecticide, such as whale oil soap or kerosene emulsion, if the tree is sprayed before they have a chance to form their scale covering.

The San Jose scale, introduced into this country about ten or twelve years ago, is undoubtedly one of the most formidable enemies of the Rhode Island fruit grower. It is safe to say that approximately one-half of the fruit trees growing or planted in this State during the last ten or fifteen years have been destroyed by this pest. This scale differs from the other two mentioned in that it does not lay eggs, the young being born alive, and the appearance of the young larvæ continues throughout the entire growing season. The last larvæ of the fall that succeed in forming a scale covering are the ones to carry the insect through the winter.

Contact sprays which can be used when the trees are in leaf have no effect on the scale insect after it has acquired a covering. It is evident, therefore, that summer spraying, to be effective, would have to be continued throughout the entire season in order to catch the young larvæ as they emerge, and before the scale covering can be formed. This would be too expensive, and spraying in the winter time, when the trees are dormant, with solutions sufficiently caustic to penetrate the covering must be resorted to. The two following types of San Jose scale sprays are commonly used: the miscible oils, which are made largely from crude oil, and the lime-sulfur sprays. Both of these have their advantages. For late fall spraying the oils may, perhaps, be as effective as the lime-sulfur. The latter, however, when well prepared and applied, is undoubtedly advantageous for spring use. It is equally effective against the scale, if the tree is thoroughly covered; it is less liable to injure the tree, and is a better fungicide. Great objections to the use of the lime-sulfur

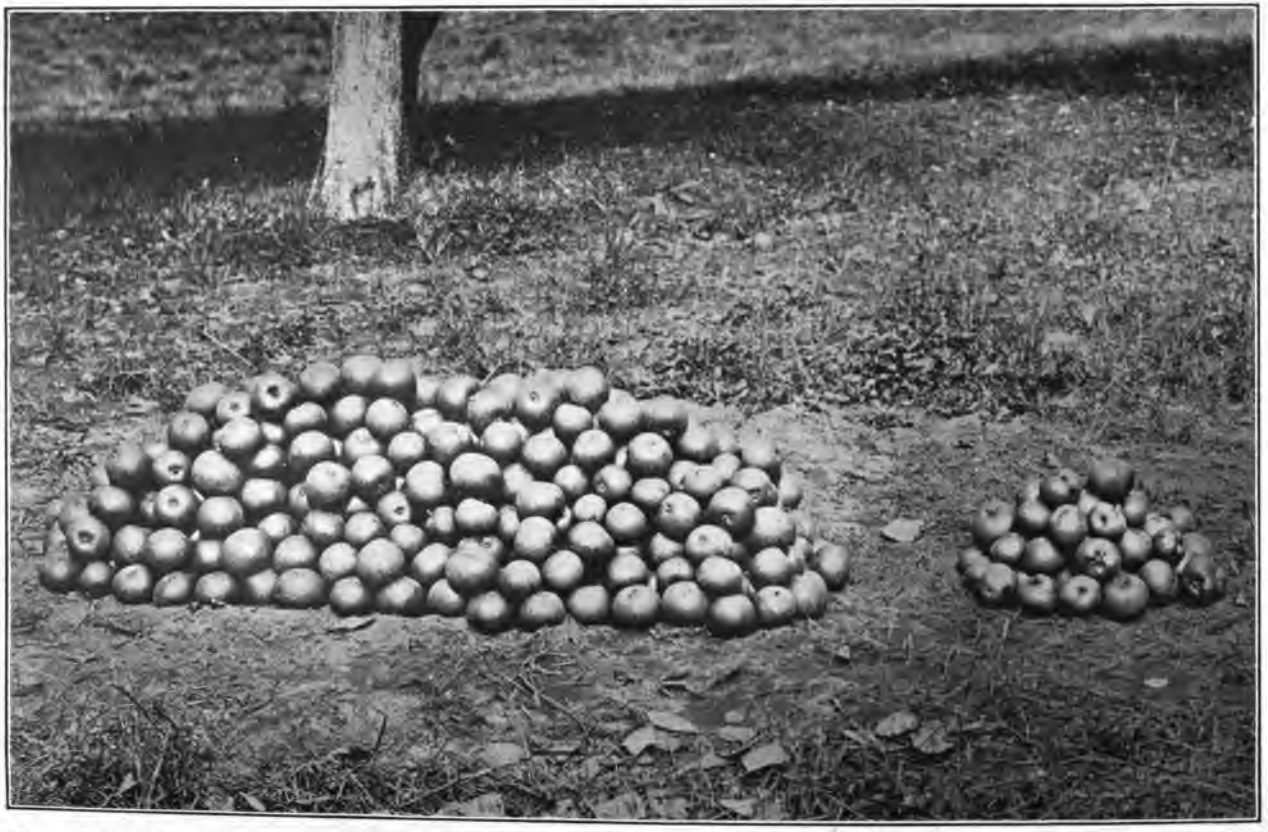

PLATE XI. Fruit from sprayed tree—perfect fruit at the left; infested with codling moth at the right. In neighboring check trees, not sprayed, the result was nearly the reverse. *After R. I. Exp. Station.*

have been raised in the past on account of the labor of preparing it. This, however, can now be obviated by purchasing the ready prepared, concentrated solution, which is simply diluted with water, generally in the proportion of 1 part of concentrated solution to 9 or 10 parts of water, and sprayed on the trees the same as the oil.

One of the essential points to remember in treating the San Jose scale is that it is enormously prolific. One female that lives through the winter may have at the end of the season three billion descendants. It is therefore evident that if only a few escape the spraying, these will multiply to such an extent that the trees will become thoroughly covered again by the following autumn. The principle which must be emphasized again and again, therefore, is that the spraying must be absolutely thorough. The insects are killed through contact with the spray, and each individual must, therefore, be hit.

A fuller discussion of this pest is given in a bulletin on the San Jose scale issued by the Board of Agriculture and the Rhode Island State College, last winter, and if further information is desired the reader is referred to this publication.

Bud Moth. This is also an insect of recent introduction, but during the last few years it has raised havoc with the apple trees in several orchards of the State.

The moth lays its eggs on the leaves of the tree in June and July, and the young larvæ, after hatching, feed on the leaves until fall when they desert the leaves and hide away in silken cocoons in the crevices of the bark of the smaller twigs and branches. In this way they pass the winter, and as soon as the buds appear in the spring they emerge and begin to feed. As the leaves grow the larvæ fasten them together with silk, forming little hiding-places within which they live while they feed upon the leaves and blossoms.

The insect can be readily controlled by a thorough spraying with arsenate of lead as soon as the leaves begin to unfold in the spring.

Tent Caterpillar. The tent caterpillar is prevalent, but easily controlled. Everyone knows its characteristic silken nest, found usually in a fork formed by two large branches. The caterpillars

retire to this when the weather is inclement, or when they are through with their feeding. They may be destroyed by spraying the tent with kerosene and burning it, or a regular spraying of the leaves for other leaf-eating insects will destroy this pest on its first appearance.

The Fall Web Worm is an insect somewhat similar in habits, but it appears in large numbers only late in the season, and spins its web at the tips of the branches, covering the leaves on which the young larvæ feed.

This insect can be destroyed in the same way as the tent caterpillar. Since the web is at the tip of the branches, the whole web can frequently be cut off and burned. Spraying with lead arsenate or Paris green is also effective.

Plant Lice are found on almost all kinds of plants, and the apple is no exception. In some seasons they are especially troublesome. Like the scale, plant lice multiply with enormous rapidity, and if weather and other conditions favor their development, they sometimes increase to a very alarming extent. Their eggs are usually laid around the buds of the trees, and spraying with oils and with lime-sulfur for the scale usually proves an effective check.

Where such spraying is not used, they must be controlled with a contact insecticide in the summer, and this should be applied as soon as possible after the insects are discovered, and before they have a chance to cause the leaves to curl. After the leaves are curled up, it is difficult to reach them with a spray solution.

The Canker Worm. There are two common species of this pest attacking fruit trees, the spring and the fall canker worms. They differ somewhat in their life history, but the general treatment is the same. The larvæ when full-grown drop to the ground and pupate in the soil. The female adult has no wings, and in order to reach the branches to lay its eggs, it must crawl up the stem of the tree. The fruit grower can take advantage of this and place bands of sticky substances, such as Tanglefoot, around the trunk of the tree so that the insects cannot ascend. An equally effective, and perhaps less ex-

PLATE XII. Oyster-shell Scale.

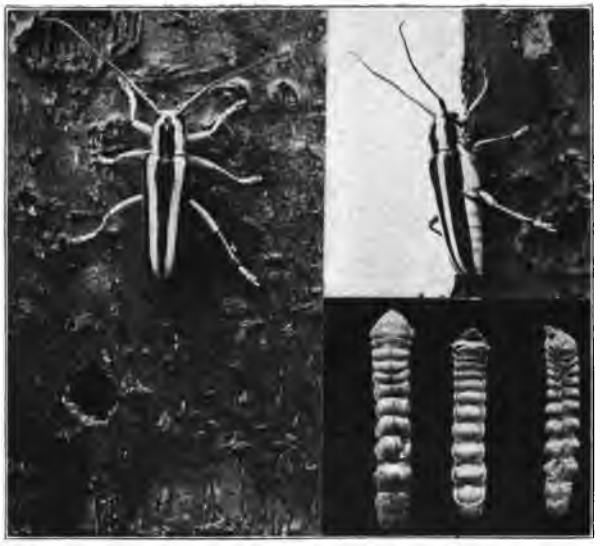

FIG. 1. Round Headed Apple-tree Borer (*Saperda Candida*). After West Virginia Exp. Sta.

FIG. 2. Pupæ of Codling Moth under a piece of apple tree bark. After Cornell University.

PLATE XIII.

pensive remedy, since it can be used against a great many leaf-eating insects, is spraying with a poison spray. The usual application of such a spray early in the summer for the other insects mentioned will also control the canker worm.

Apple-Leaf Trumpet-Miner is another insect of recent introduction which has caused considerable alarm among some of our orchardists. As it lives most of its life between the upper and lower surfaces of the leaves, where it cannot be reached either by contact or poison sprays, it is a difficult insect to control. Fortunately, it does not occur in very large numbers until rather late in the summer, when most of the work of the leaves is over.

*The Codling Moth,** which attacks the fruit, is perhaps, after the San Jose scale, the most pernicious foe which troubles the apple grower. It attacks all kinds of apples, and in some seasons ruins 50 per cent or more of the crop. Recent investigation has revealed that the larvæ of the first brood enter through the blossom end of the young fruit soon after the fall of the petals, and experiments indicate that a thorough spraying at this time with lead arsenate, and with the spray so directed that it covers the blossom end of the fruit thoroughly, will effectually control this pest and reduce the amount of wormy fruit to less than 5 or 10 per cent of the total crop. Even this small amount may be reduced somewhat later by thinning out all the infested fruit.

The insect winters over as a pupa, usually under the rough bark of the apple trees, and this harboring place can be rendered untenable to a large extent by scraping the trees and removing all loose pieces of bark.

The Apple Maggot, or Railroad Worm, is a native pest which used to live in the fruit of the hawthorn and other wild relatives of the apple, but which in recent years has acquired a healthy appetite for some of our best apples, especially some of the early varieties.

The adult is a fly which, by means of a sharp ovipositor, deposits an egg under the skin of the apple. The larva burrows zig-zag channels throughout the entire fruit, but never comes to the surface

*See Plate XI, and Plate XIII, Fig. 2.

where it can be reached by any spray until it is ready to enter the ground to pupate. Usually the apple drops before this occurs, and this points out to us the only remedy against the pest: namely, im-

Maggot. Pupa. Adult form, or fly.

FIG. 18. Apple Maggot. After Me. Exp. Sta.

mediate destruction of all the fruit that falls to the ground. Pasturing sheep and hogs in the orchard, and giving chickens free range will help very much in controlling the pest. The adult is an active flyer, and undoubtedly travels for some distance. It is essential, therefore, that apples containing the maggots which are carried to the store room should be destroyed so far as possible, and if any of the maggots escape destruction and pupate within the store room, the building should be so constructed that the flies cannot escape.

The Plum Curculio frequently does a great deal of damage to apples, not in the same way that it injures the plum and cherry through the work of its larvæ, because the larvæ probably never develop in the apple, but by puncturing the skin of the apple and thus establishing a starting point for apple scab and other plant diseases.

The life history of this insect has not been studied sufficiently to give us exact information, but it is believed that the adult beetle feeds on the young leaves of the apple as well as of the plum in early spring, and that it can be controlled, in part at least, by the regular poison sprays applied at this time of the year. Since it propagates in plums and cherries, it is evident that trees of this kind should not be planted among or very near the apple trees. If chickens are allowed the run of the plum and cherry orchard, it is probable that they will destroy a great many of the curculios, and perhaps provide an effective check to their increase.

PLANT DISEASES.

Plant diseases belong, with a few exceptions, to a low order of plants called "fungi." These do not grow from seeds, but from specialized cells which function in a way similar to seeds in propagating the plant. These spores are exceedingly small. All are microscopic, and some can only be seen under quite high-power lenses. The spores are disseminated by wind or slight air currents and germinate under favorable conditions by sending out a little fungous thread. Some of the fungi, like the common mildews, grow almost entirely on the outside of the host plant and secure food by sending special branches called "haustoria" into the living cells of their host plant. The majority, however, penetrate the tissues of the host plant and grow among the cells during their entire life cycle or until they are ready to produce spores, when specialized fungous threads are sent to the surface. It is the appearance of these spore-bearing fungous threads at the surface, generally rupturing the epidermis of the host, that makes us aware of the presence of the disease and that spoils the appearance of the fruit.

Fungi of the first-mentioned class which grow on the outside of the host plant can be destroyed at almost any time by the proper application of fungicides. It is evident, however, that if we wish to destroy those of the second class before they have done their damage, we must destroy the spores before they have a chance to germinate and send the resulting fungous threads into the tissues of the host plant. This is done by keeping the plants covered with some solution which destroys the spore at the time of its germination. The principal remedy used in the past has been the Bordeaux mixture. Recent experience with this spray on apples seems to indicate that it may be injurious to the fruit. Under certain climatic conditions it causes a russeting of the apple which, while it does not always produce malformed fruit, nevertheless renders it less salable. This is undoubtedly due to the action of the copper, either because sufficient lime has not been put into the solution, or because some of the copper

has been, under special climatic conditions, dissociated from the lime. The remedy is the use of a smaller amount of copper sulfate, say, 3 pounds instead of 5 pounds in the 5–5–50 formula, or the substitution of one of the sulfur sprays, which are now highly recommended.

Apple Scab is perhaps the most important of the plant diseases attacking apples. It attacks both leaves and fruit, showing as dark-colored blotches on the former, and as rough, scabby spots on the latter. On the fruit it is especially likely to start in punctures made by the plum curculio. Fruit attacked late in the season may not be greatly injured, except in appearance, but when the disease is prevalent and the fruit is attacked while young, it frequently causes distortion, checks the growth, and renders the fruit entirely unfit for use. Scabby fruit in storage is also liable to be attacked by the pink rot, which starts in the places where the scab has ruptured the skin of the apple. See Plate XV.

Canker is a term applied to diseases which attack the cambium or sapwood of the trees, causing wound-like scars and distortion of the branches. Frequently when the disease has an opportunity to continue its development, the branch will be entirely girdled and destroyed. This disease is especially prevalent on trees that are not properly cared for, and gives but little trouble when the trees are vigorous and carefully pruned and sprayed.

One of the canker diseases attacks the fruit and is known as "*bitter rot.*" Its presence is first indicated by small, brown, discolored spots at the surface of the apple, which rapidly increase until a large part of the substance of the apple is permeated by the mycelium of the fungus. As the disease develops, concentric circles of little pustules are formed on the surface of the diseased fruit. These contain the spore-producing hyphæ of the fungus, which eventually break through the skin of the apple and disseminate the spores. The further life history of this disease cannot be entered into, since it is quite complicated. Suffice it to say that it can be generally controlled, except in a very few varieties which are especially subject to it, by

PLATE XIV An Orchard well sprayed with Lime-Sulfur. After Va. Crop Pest Commission.

keeping the trees vigorous, and by a thorough spraying once or twice a year with an efficient fungicide.

Leaf Spots. The apple is attacked by a great number of fungi which cause a spotting of the leaves. One investigator* in West Virginia has found 18 different species of fungi causing such leaf spots. Generally, they are not especially injurious, since the greater part of their growth occurs in late summer after the leaves have nearly completed their functions. They are generally controlled by the usual sprayings given for other diseases.

Blight is the only serious and common disease of the apple, which is caused by a bacterium. This disease attacks the pear with even greater virulence than the apple, and is, consequently, called the "pear blight" rather than the apple blight. In this State the disease does not seem to be very prevalent either on the pear or the apple. Should it occur, it can be readily controlled by cutting off the diseased branches as soon as they are noticed.

THE SPRAY REMEDIES.

A complete discussion of spray remedies cannot be entered into here. A few general directions regarding the principal formulas will be given, but for details the reader must refer to the spray bulletins already mentioned.†

INSECTICIDES.

As already indicated in the preceding discussion, insecticides may be divided into two classes: Contact insecticides, of which whale oil soap, kerosene emulsion, the miscible or (soluble) oils, and the lime-sulfur washes are examples; and the stomach poisons, of which lead arsenate and Paris green are the most familiar.

*Hartley, Sci. No. 684, 1908.

†*Bul* 100, *R. I. Exp. Sta.*, and *The San Jose Scale* pub. by the Extension Dept. R. I. State College and the State Board of Agriculture.

The most important contact insecticide is the *kerosene emulsion*, which is prepared as follows:

Take ½ pound of laundry or whale oil soap, and 1 gallon of hot water. Slice the soap, and dissolve it in the hot water, over a fire if necessary. When this has been accomplished, *take the mixture away from the fire*, and add slowly 2 gallons of kerosene, stirring constantly. The mixture should be pumped back into itself, or agitated, until a creamy liquid without any free oil on top is secured. This mixture is the stock solution, which must be diluted according to the strength required. A 10 per cent solution is generally advocated for most insects in the summer time, and this is secured by adding 17 gallons of water to the above quantity of stock solution. Smaller quantities may of course be secured by mixing the proportional parts of water and stock solution.

The miscible oils and the lime-sulfur solution can be prepared by the orchardist, but under most circumstances it is better to buy the concentrated solution from the manufacturers. For those who wish to prepare any of these for themselves, reference can be made to the bulletin on the San Jose scale already mentioned.

Poison sprays are generally made by mixing either lead arsenate or Paris green with water. The latter poison is the better-known, but now considered less desirable than the former. Lead arsenate should generally be mixed with water at the rate of from 2½ to 3 pounds to 50 gallons; and Paris green, at the rate of from ¼ to ½ pound to 50 gallons of water.

Lead arsenate is the more expensive in first cost, but it adheres better to the foliage and will hardly ever injure the plants sprayed. Paris green, on the other hand, is readily washed from the leaves, and if it contains free arsenic, as many brands do, is very liable to burn the foliage.

Both Paris green and lead arsenate can be used with Bordeaux mixture, or the lime-sulfur summer sprays in the proportions above given.

Apple Scab—A, early stages B, results of a bad attack.
After Cornell University.

PLATE XV.

FUNGICIDES.

For plant diseases, remedies called "fungicides" must be applied. Hitherto solutions containing copper have been used almost entirely for the spraying of orchard trees, but recent experience indicates that under certain conditions these solutions, as formerly prepared, cause a russeting of the fruit. To obviate this, it is now advocated that a smaller amount of the chemical containing copper should be used; for instance, in the Bordeaux mixture a formula containing 3 pounds instead of 5 pounds of copper sulfate to 5 pounds of lime and 50 gallons of water should be used. It is recommended by some that copper sprays should be abandoned altogether and that sulfur sprays should be substituted. The self-boiled lime-sulfur mixture has a number of advocates. This is made by mixing 8 pounds of sulfur with hot water and pouring the mixture over 10 pounds of quick lime in a barrel. Enough hot water should be added for the lime to slake well. The mixture should be well stirred, and then the barrel should be covered over with a blanket, to confine the heat, and left until the slaking ceases, when water is added sufficient to make 50 gallons, after which the mixture should be strained into the spray tank.

A number of manufacturers of spray chemicals are putting out sulfur compounds for summer sprays, many of which are highly recommended by reputable parties, but as yet they have not been tried for a sufficient length of time so that they can be given an unqualified recommendation.

PROTECTION AGAINST MICE AND OTHER RODENTS.

In mulched orchards, especially, mice sometimes cause a great deal of damage, particularly to young trees, by gnawing the bark at the base of the trunk. This may be prevented largely by mounding the trees with earth to a height of 8 or 10 inches. Various washes are also recommended, but the best, and probably the cheapest, method is to surround the base of the tree with wire mesh, such as pictured in

Plate XVI, Fig. 2. Galvanized wire netting with 5 or 6 meshes to the inch can be bought of suitable width and cut into 10-inch lengths, or sufficient to encircle the trunk of the tree and give room for growth. A man should cut and put on from 200 to 300 of these a day, and the total cost should not exceed 10 cents per tree. They should last eight or ten years, or until they are no longer needed to protect the tree. This wire netting will also prevent, to a large extent, attacks of rabbits and woodchucks.

THE RENEWAL OF OLD OR NEGLECTED ORCHARDS.

Many farms in various parts of the State have once had flourishing orchards, but owing to the decline of interest in fruit growing they have been neglected for a number of years. The result has been that the trees are usually low in vitality, moss-covered, and diseased, made up of a tall trunk with a few long main branches and a bouquet of leaves at the top, sometimes twenty or thirty feet from the ground. Some of these trees are so old, or have been neglected for so long, that they are hardly worth an attempt at renewal. Sometimes the pruners have left long stubs of branches, and these have started decay which has penetrated into the trunk and down to the roots so that scarcely any of the heartwood remains. Such a tree had better be cut down first as last. On the other hand, if the trees are not too far decayed, and not over forty or fifty years old, they may be renewed and made to bear for a number of years until a new orchard can be brought into bearing, and it is the purpose of this chapter to discuss how this may be done.

The first task will be to prune the trees rather severely and cut out all old, dead branches. Rectify the mistakes of previous pruning so far as possible, by cutting off the dead stumps close to the trunk or branch from which they have sprung. If decay has started, it is well to clean out the cavities, paint the inside with coal tar, and fill with cement. All wounds (over an inch and a half in diameter) made in pruning should be carefully painted with white lead and linseed oil. In pruning old high-headed trees it is well to have in

FIG. 1. Corn-stalk tree protector; cheap; but must be removed every year, and not always effective. After Ohio Exp. Sta.

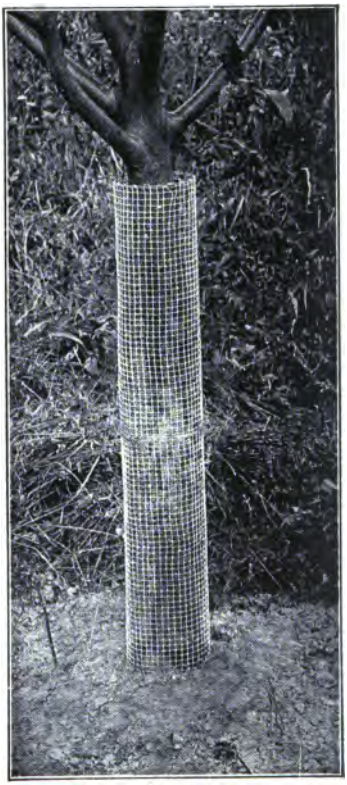

FIG. 2. Wire-netting tree protectors for trunks of trees. Cheap and durable. Picture shows two cylinders, one above the other. One is usually sufficient.

PLATE XVI.

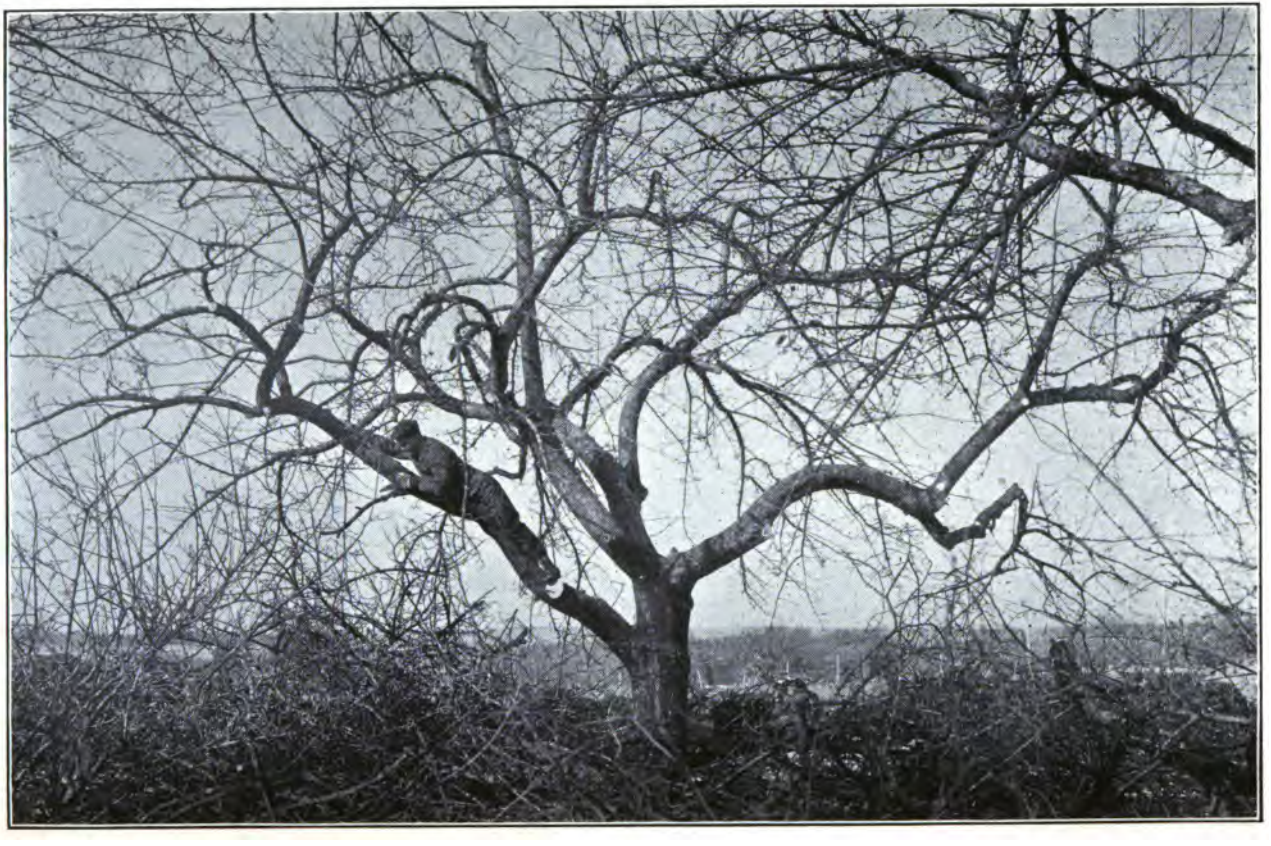

PLATE XVII. Results of a determined attack on a neglected apple tree.

mind the ultimate lowering of the top. It is probable that severe pruning will start a number of new sprouts from different parts of the trunk and branches, and by retaining and encouraging the sprouts which appear in the right places, and by gradually cutting out all the old wood, it is quite possible to renew the entire top and bring it within a reasonable distance from the ground. If the variety is not the one wanted, these new sprouts may be grafted or budded with some more desirable sort.

Scrape the trunk and larger branches quite severely, removing all old, loose bark, but do not cut into the live bark to any great extent. Occasionally trees that have remained at a standstill for some time, owing to the lack of cultivation and care, have made but little growth and have become "bark-bound." Severe scraping will remedy this to some extent, but often it will help the tree to run a sharp knife entirely through the bark, lengthwise of the trunk, from the roots to and along the under surface of the larger branches.

The next thing to do is to spray the trees just before the leaves come out with strong Bordeaux mixture, or, if the scale is present, with the lime-sulfur wash. This will destroy the lichens and mosses which are generally found on old trees, and with the aid of later sprayings will prevent the attacks of various fungous diseases during the summer season.

In order to do their best trees must have plant food, and a basic fertilizer, such as mentioned under the discussion of fertilizers, should be applied as soon as the ground can be worked in the spring. Since these old trees need encouragement of wood growth, it would also be well to apply some barnyard manure or else add nitrate of soda to the basic formula. The ground should then be plowed, but not too deep, since it may cause too great injury to some of the larger roots. This will bring the fertilizer in contact with the roots. It will break some of the older roots, and cause the development of young feeding-roots to take up the plant food provided.

If plowing is impossible, the orchard may be fenced and hogs turned in. See Plate VII, Fig. 2. If they fail at first to root up the

ground, they may be encouraged to do so by making holes in the soil here and there throughout the orchard with a crowbar, and dropping in some corn.

The plowing should be followed with thorough cultivation up to about the middle of July, when a cover crop, preferably some legume, should be sown. One or two more sprayings should also be given during the summer. If the trees blossom and fruit can be expected, one of the two sprayings should be given immediately after the falling of the petals, as described under the chapter on apple pests and spraying.

Young orchards badly injured by the scale may be preserved in much the same way, but they can be cut back much more vigorously at once, with the assurance that the young growth, if kept free from the scale, will soon renew the top. See Plate XVIII, Figs. 1 and 2.

CAUSES OF FAILURES.

We frequently receive questions something like this: "What is the matter with my apple trees? They fail to bear."

To answer such a question as that, without further detail, is about as difficult as it would be for a doctor to diagnose a case by the patient simply telling him that he had a pain in the chest.

The causes of failures are many and varied. Frequently failure is due to the fact that the grower expects to reap two crops from his soil, in the shape of hay or pasturing and fruit, without fertilizing or giving the trees, or even the soil, any care except that which is necessary to grow the grass. Such treatment is very likely to lead to disappointment.

Embraced in this lack of care are a number of different items, such as lack of fertilizers and cultivation and proper pruning and spraying.

Other causes are winter root killing, root rot, collar rot, drought, and sunscald; insects, such as the San Jose scale and bud moth; the absence of proper pollination, and, in single trees, an individual disinclination to bear. Sometimes whole orchards are shy bearers without any apparent reason, and while nothing is definitely known in regard to

FIG. 1. A determined attack on the San José Scale.

FIG. 2. The result.

PLATE XVIII. *Orchard of Rev. J. E. Hawkins, East Greenwich, R. I.*

such behavior of trees, it is presumed that in some cases, anyway, it may be due to the selection of scions from trees which have been lacking in the quality of good bearing.

REMEDIES.

The first remedy is the removal of the cause, if known. If it is due to lack of cultivation, plant food, spraying, or pruning, the remedy is obvious. If it is due to lack of proper pollination, it may be remedied by introducing bees, to carry the pollen from other trees in the neighborhood, or by grafting into the tree certain strong, pollen-bearing varieties which blossom about the same time as the original trees.

Tardy or shy bearers may sometimes be induced to mend their ways by severe scraping; pruning, especially if it is done in early summer; seeding the ground to grass, if it is cultivated; and in some cases by girdling the trunk of the trees or some of the larger branches.

If these remedies do not bring success, the only other alternative is renewing the top by grafting or budding from bearing trees of the same or a different variety.

Collar rot and sunscald attack only certain varieties and can be prevented by top grafting these varieties on vigorous stock, such as the Tolman and the Northern Spy.

Drought is obviated to a large extent by thorough cultivation; frost injury, by cover crops; and the insects mentioned, by proper spraying.

DWARF APPLES.

During the past few years a great deal of interest in dwarf fruits of various kinds has been manifested among both the amateur and practical growers. Theoretically, dwarfs should solve some of the problems with which the grower has to contend. It is argued that on account of their smaller size they can be more easily sprayed, and injurious insects, such as the San Jose scale and the codling moth, and plant diseases can be more readily controlled. They can be more

easily pruned, and the fruit can be more readily thinned and harvested. More trees can be planted to the acre. They are better adapted to small gardens than the standards, and they bear at an earlier age. This last argument has brought them prominently into consideration as fillers or temporary trees in orchards of standard trees. In Europe, where land is high priced, and labor cheap, and where a great deal of attention is paid to the growing of fancy fruit, dwarf fruit trees are of great importance.

In this country, practical experience has not been favorable to the use of dwarf trees, and they are not generally recommended, except perhaps for the amateur orchardist on small plots, for fruit trained as espaliers or cordons, or in part (experimentally) for fillers, in orchards of standard trees.

Dwarf apples are produced by budding the standard varieties on a slow-growing stock. Two stocks, the Paradise and the Doucin, are used. The former produces the dwarfest form and is used largely where the trees are to be trained. The Doucin produces a tree about midway in size between the Paradise and the standard trees.

Dwarf trees, even if grown in bush form, require considerably more care than standards, especially as regards pruning, and it is unwise for anyone to enter upon their cultivation without first giving considerable study to the methods employed.

Most varieties of apples can be grown as dwarfs, but it is evident that only those of highest quality should be employed, since the price paid for medium or poor quality apples would not pay for the extra expense of caring for dwarf trees.

Among those recommended, the following varieties may be mentioned: Red Astrachan, Williams, Cox Orange, Mother, Primate, Gravenstein, Maiden Blush, Northern Spy, King, Esopus, Wagener, and Jonathan.

For those who wish to look into this subject further, the following books are recommended: Waugh's "Dwarf Apples," and those who can read German can refer to Die Zwergobstbäume, by Loebner.

FIG. 1. Different forms of trained fruit trees. *School of Horticulture, Versailles, Paris, France.*

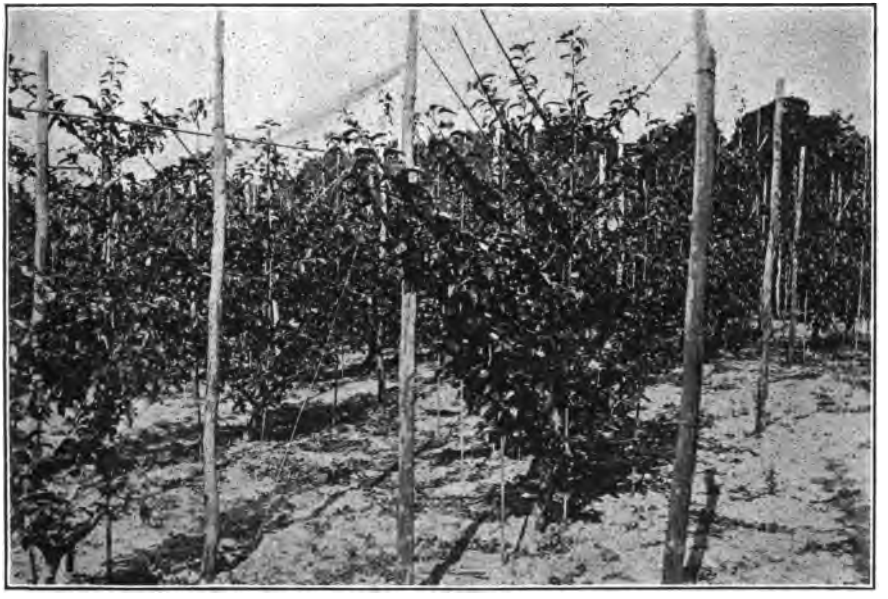

FIG. 2. Dwarf trees in Sparth's nursery, *Baumschulenweg, bei Berlin, Germany.*

PLATE XIX.

HARVESTING AND MARKETING.

We might divide orcharding into two branches: fruit growing and fruit disposal. The latter is as important as the former. Many orchardists are excellent growers, but fail in gathering and disposing of the crop, and, consequently, do not reap the full benefit of their labors.

During the last few years, owing to the increase in export trade and the development of fruit growing as a specialty in Canada and various parts of the United States, there has been a wonderful progress in methods of harvesting and disposing of fruit products. In the principal apple-growing sections, good methods of picking, grading, packing, storing, and marketing apples are the rule rather than the exception. The market ideals have risen, and while first-class products to-day are bringing more than they ever did, it is proportionately harder to sell inferior ones. It is therefore absolutely essential that all fruit growers should acquaint themselves with the progress in this line of their business and take advantage of all the knowledge relating thereto that they can obtain.

PICKING.

No hard and fast rules for picking different varieties of apples can be given. Something depends upon whether they are for the local market and immediate consumption, or for shipping or storage. Early apples intended for immediate use should be allowed to more nearly ripen on the trees. In this way they gain in color and in quality. Such apples should not be picked all at one time, but the trees should be gone over at intervals to gather the fruit that is ripe for market. Late apples, of course, should not be allowed to remain on the trees until fully matured, since they naturally ripen in storage, and they should be gathered at one picking.

A general rule followed by some is to pick when the stem snaps readily from the spur. Other growers watch their trees, and when the apples begin to fall, they consider it time to begin picking.

The most reliable test of ripeness, as followed in the Pacific Northwest, is in the color of the seed. When the seeds begin to turn light brown and before they become dark around the edges is considered to be the best time for picking the apples. Special rules for certain kinds are sometimes given; for instance, one commission merchant says that Snow apples should be allowed to remain on the trees until they have a good, fresh color. Dull-looking Snows are hard to sell. The same man prescribes that Grimes Golden and Fall Pippins should be allowed to turn partly yellow before picking.

Various kinds of ladders are used in picking fruit, from a stepladder to the long straight ladder which is leaned against the trees. For a stepladder it is essential to have one with three points of support.

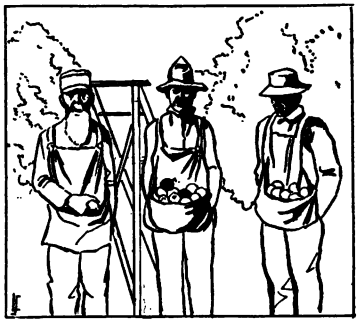

FIG. 19. Apron Bags for Pickers.
After Idaho Exp. Sta.

The two parts of the ladder proper should be widely separated and the support should meet at a single point on the ground.

So far as possible, pickers should not be allowed to climb around in the branches of the trees, since many of the fruit spurs are rubbed off in the process. The old-fashioned way of shaking the trees and gathering as much fruit as possible before using the ladders is, of course, obsolete at this day when the object is to pick fruit without any bruises. All fruit must be picked directly off the tree. A burlap-lined basket is excellent, but the apron bag shown in Fig. 19 is recommended by western fruit growers as being the safest recep-

FIG. 1. Fancy paper lining for head of barrel. From Prem. List, N. E. Fruit Show.

DIAGONAL. STRAIGHT.

FIG. 2. Two forms of box packs. After Idaho Exp. Sta.

PLATE XX.

tacle for picking fruit. It is particularly applicable in picking the fruit from modern, low-headed trees, since the time consumed in climbing down the ladder to the ground and emptying the bag directly on the packing table or into temporary package does not amount to so very much.

Another form of bag, hung at the side with a strap over the shoulders, is also used a great deal, but it is more liable to cause bruising of the fruit.

In picking, the fruit should be grasped firmly in the palm of the hand with the thumb and forefinger so placed on the stem that by a little twist or push the stem can be broken clean from the spur. Fruit should never be without the stem, nor should broken spurs remain attached.

The fruit when gathered may be loaded at once on the packing tables to be placed in permanent boxes or barrels, or it may be loaded temporarily in barrels or boxes and taken to the storeroom for subsequent packing. The old-fashioned way of picking the fruit and leaving it in windrows exposed to the sun and weather is not considered good practice at the present time. The quicker the fruit is removed to temporary cold storage or to permanent cold storage after it has been picked, the better it will keep.

When the picking of the fruit from the tree is over, windfalls should be gathered, graded so far as possible, and disposed of for what they will bring. Such apples should never be sold under a trade-mark or with the grower's name attached.

The method of hiring pickers varies in the different localities. In some places they are hired by the day, and in others they are paid by the barrel. In the former case they receive from $1.50 to $2 a day, and in the latter, from 10 to 12 cents a barrel. It is possible to get the work done a great deal more quickly through paying by the barrel, but the question naturally presents itself whether the fruit is as carefully picked by this method. According to one grower, the average number of barrels picked by a man under the day labor system is from 15 to 20. Others say that an average of 30 barrels a

day should be reached. Of course, this will vary a great deal with the quantity of fruit and the form of the trees. Powell states that it costs 20 cents to pick a barrel of apples from a high-headed tree, and only 7 cents from a low-headed one, indicating that the height of the tree makes a great deal of difference in the time consumed. Under the per-barrel system some wonderful records have been secured. According to an article by Clark Allis of Orange county, New York, in the Rural New Yorker of February 16, 1907, one of the pickers of his vicinity picked 80 barrels in 8 hours, and was willing to bet $100 that he could pick 100 barrels in 10 hours. He also says that good pickers should gather from 40 to 50 barrels per day. Another record is that of William Vine, Greece, New York, who picked 63 barrels in one day of 9 hours.

GRADING.

No one should attempt to pack or market apples without carefully grading them. Commission merchants find that packages containing a mixture of large and small apples are hard to sell, and bring a lower price than apples uniformly small. A barrel containing two-thirds No. 1 and one-third No. 2 will sell for No. 2. Large apples in a package accentuate the fact that the smaller ones are undersized. By grading, therefore, the orchardist receives the same, or nearly the same, price for his small apples that he would for a mixed product, and a higher price for his larger ones. Grading should aim to secure uniformity in size and general appearance. In special packages, uniformity in color should also be aimed at.

In grading, all wormy apples are, of course, discarded and added to the windfalls or culls. With inexperienced packers it is sometimes well to have some method of measuring the comparative size of fruit on the packing table. A small hole of the required size in the side of the packing table is used for this purpose. In the west, special machines are occasionally employed for grading the fruit.

Packing tables are variously constructed with wood and canvas bottoms, and horizontal or sloping. For packing barrels, a sloping

table is used by a great many growers. At the lower end the table narrows and ends in a canvas or burlap tube, something like a bottomless sack, the lower end of which can be put into the barrel. The fruit is gradually moved towards the lower end of the table, and the packer watches it closely as he passes it into the cloth tube. Any seconds or culls are carefully picked out and placed in baskets. If such a table is employed, care must be used that the fruit does not have a chance to fall for any distance, and get bruised. With level tables, the fruit is sorted into baskets similar to those described for picking, and when filled, they are lowered into the barrels and turned over so as to give the minimum of fall to the fruit. This is by far the best method.

KINDS OF PACKAGES.

Apples are sold principally in barrels and in the so-called "bushel boxes." For local trade and for first-class early apples, smaller packages, such as the New Jersey and Michigan peach baskets, are sometimes used. These packages are employed more largely by the fruiterers or grocers, who buy their apples in large quantities and repack them into the smaller packages.

The box is pre-eminently the package for first-class apples. It is especially valuable in packing thin-skinned fruit that is liable to become bruised in transportation. It has been found that boxes pack better in cars and in the holds of vessels, and the box is, therefore, being used a great deal for long-distance rail shipments and for export trade.

PACKING IN BARRELS.

One of the first questions which comes up in connection with barrel packages is that of whether to use new barrels or good, second-hand ones. The question hinges largely on the price. Commission merchants say that apples packed in *good, clean,* flour barrels bring just as good price as those which come in absolutely new barrels. Sometimes, however, the amount of work necessary to prepare a second-hand barrel for use and the additional quantity of fruit re-

quired to fill a barrel of this kind will more than offset the amount of money gained in their purchase.

E. C. Miller of Haydenville says that it will require about 1,000 barrels of apples from new apple barrels to fill 950 flour barrels, showing a net gain, for the regular size, of 40 to 50 barrels out of 1,000—an item worth considering.

If the barreling is to be done in an orchard, it requires a sorting table and solid ground, or else a platform, on which to set the barrels while filling them.

Place the first layer of fruit in the barrel very carefully with stems down, beginning at the circumference of the barrel and putting the apples in concentric rows until the center is reached. The second layer should then be carefully arranged, and a special effort should be made to place the apples so that the fruit of this layer which shows through the spaces of the first layer will present its most attractive side. A half-bushel of fruit may then be carefully poured in, after which the barrel should be well shaken. Fill up the barrel, shaking from time to time so as to settle the fruit. When filled, the apples should come slightly above the chime, and the last layer should be faced, so far as possible, in a way similar to the first layer. At this time, and also while filling the barrel, it is well to press down the fruit gently with the hands.

Now comes the most difficult part of all, the pressing. The following account from a bulletin by F. Newhall & Sons, of Chicago, extensive apple packers, will give a very good account of the process:

"If after the last shaking the apples are about an inch and a half above the chime, or top of the barrel, you have about enough in, and you should proceed to level off and press down with the hands until the apples are only a very little above the level of the barrel and ready for the press. A very good way to fix the end ready for the press is to have a false head about the size of a regular barrel head, but made very strong with cross pieces. On each side of this head tack a piece of leather in such a manner that it will make a place for your thumbs to go through. After your barrel is filled about an inch above the chime, place this false head on the apples, and then with your

thumbs through the leather holds and your fingers grasping the top hoops of the barrel, shake and press down at the same time. This will make the barrel solid full. Then level a little more with the hand

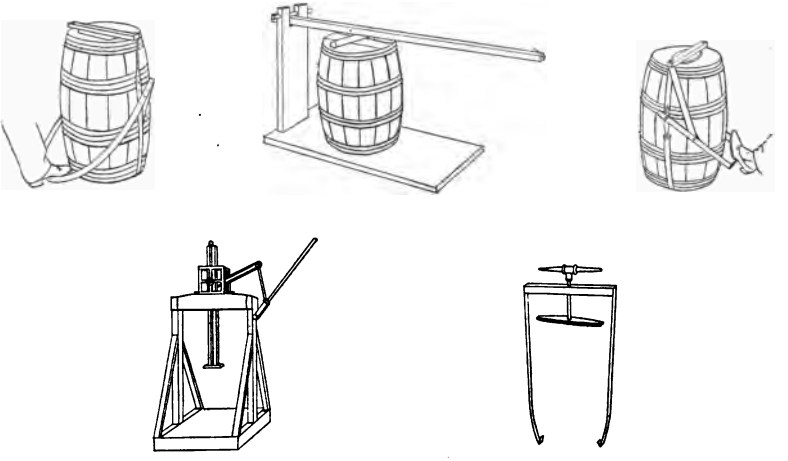

FIG. 20. Different forms of presses for barrel packing.

as follows: Place the outside ring first, much as you do on the face end of the barrel, although of course you will not get them as level as on the face end, as the pressed end will not be perfectly level anyway. You must put each apple in place with the right hand and hold them there with the left, and when you find an apple that is too large or too small, change it for a larger or smaller one. This will level off finely, and you will now be ready for the press. Use the press carefully.

"Place the barrel head evenly and squarely and place the press block exactly in the center. Do not pound on the head with the hatchet a bit more than you can help, and do not screw the head down below the proper place for it and then let it draw back, as this is sure to smash the apples. When you have the head screwed into place, nail it securely, driving the nails in slanting downward so each nail will show a little above the head of the barrel. A good plan is to drive each nail where the pieces of the barrel head come together, so each nail will do double work."

Some growers place a loose cushion head of paper under both the head and bottom of the barrel, and very careful packers will place

a circle of fancy white paper around the head of the barrel before facing the first layer, giving an appearance as shown in Plate XX, Fig. 1, when the barrel is opened. Barrels may be lined with thin, white paper, which adds to the attractiveness of the package. Whether this will pay or not, depends upon the price which can be secured for the fruit in the market.

After the head, or what is really the bottom, is nailed in, the barrel should be turned over and stenciled with the grower's name and address, the variety of fruit, and the grade.

PACKING IN BOXES.

As already noted, the box is pre-eminently the package for the finest grade of apples. It is a favorable commentary on the excellent work of the Pacific-coast growers that a very large amount of the fruit that comes from that section of the country is sold in boxes.

To pack successfully in the box looks simple, but it really requires considerable training and practice.

The size of the box varies with the locality. The two sizes most commonly used are the standard size, which is 10½ by 11½ by 18 inches, and the special size, which is 10 by 11 by 20 inches. The former contains just about a bushel, or exactly 2,173.5 cubic inches, while the contents of the latter is somewhat greater (2,200 cubic inches). The bulge in top and bottom adds about 150 cubic inches to the capacity of each. The ends should be made of ¾-inch stock, the sides of ⅜-inch, and the top and bottom of ¼-inch material. The cost of such boxes varies with the locality, but it is usually between ten and fifteen cents apiece. The following, from the pen of George T. Powell, may be interesting in this connection:

"For several years at Orchard Farm we have been shipping not only apples but pears in boxes. We use the 40-pound standard box, which costs, made at the farm, 11 cents. The cost of packing and wrapping one of these boxes at the start was 5 cents, which has been reduced to 4 cents. The cost of wrapping and packing a barrel is 20 cents. The expressage on a 40-pound box of apples from Ghent to

New York is 50 cents; the cost by freight in carload lots is 6 cents per box, the advantage being altogether in favor of shipping such fruit in carload lots. The cost of freight upon a single barrel of apples is 24 cents, while in carload lots the fruit may be shipped for 18 cents a barrel.

"I am glad to give a few points upon the value of fruit sold in boxes: I have just received this morning, from my superintendent, the following: 'Two hundred boxes of Rhode Island Greenings sold in the commission market, through a commission man, for $2 per box.' The expenses are as follows: Cost of box 11 cents; wrapping and packing 4 cents; freight 6 cents; storage 15 cents; commission 20

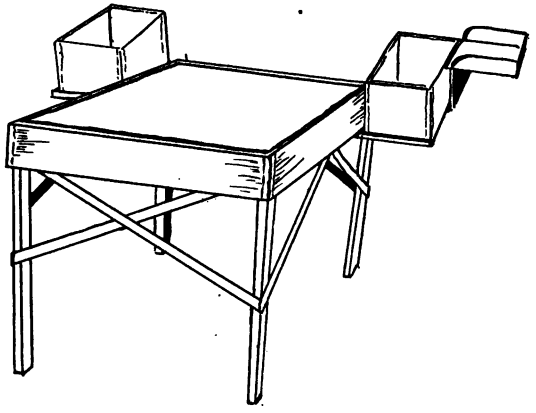

FIG. 21. Table for Box Packing.

Boxes should be placed on diagonally opposite, instead of on opposite corners as indicated in picture.

cents—making the cost 56 cents, and leaving $1.44 per box. It requires four of these boxes to make a barrel. Consequently the fruit as sold leaves a net value per barrel of $5.75. The highest quotation this morning is $5.50 for Rhode Island Greenings, which must be strictly fancy stock, and out of that must come the cost of the barrel, freight, cartage, commission, etc., which will be at least $1.25, leaving the net price $3.25 per barrel. This leaves a very satisfactory margin of profit upon the box over the barrel."

For the work of packing, a table similar to the one pictured in Fig. 21, should be used. The framework of this is made of wood, and the

bottom of burlap or canvas. In order to still further protect the fruit, a rubber hose may be nailed on the edges of the frame. On either side near opposite corners is a frame on which the box rests in an inclined position. A removable shelf can be attached to the side of the box to hold the paper for lining the box and for wrapping the fruit. Two packers work at such a table.

Various systems of arranging the fruit are used, according to the size of the fruit. They are termed the straight, diagonal, and opposite. Each of these may vary in the number of apples which the box will eventually contain, depending upon the size of the apples packed.

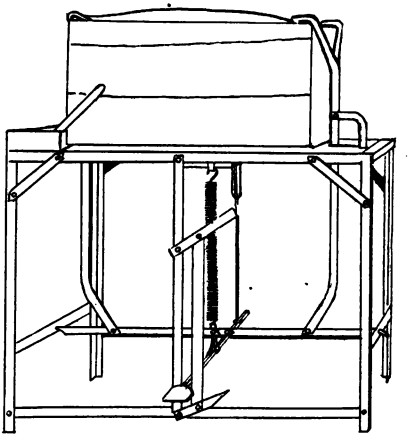

FIG. 22. Press for Box Packing.

Plate XX, Fig. 2, shows two boxes packed ready for the cover in the diagonal and straight packs, respectively.

Apples packed in boxes are nearly always wrapped, each fruit in a single piece of paper. When the box is filled it should have a bulge of about an inch at the center in order that the pressure of the cover when nailed on will hold the fruit compactly in place. For forcing the cover into place for nailing, special presses are used, an illustration of which is given in Fig. 22. Those who use special care in packing, place a cardboard in the bottom of the box and line the sides with paper. A rubber tip is worn on the thumb or first finger of the left

hand to help the packer pick up the sheets of wrapping paper easily. This paper is usually about 8 to 10 inches square, and white. In packing, the paper is picked up and placed in the palm of the left hand, an apple is picked up by the right, a glance indicating whether it is the correct size and grade, and with a quick twist the paper is wrapped around the fruit. The wrapping serves to cushion the fruit, takes up slack in the package, and preserves the aroma of the fruit, and to some extent also prevents decay.

The injunction that only the very best quality of fruit should be used throughout the package is even more important with the box than it is with the barrel.

A single packer may put up as much as 100 boxes per day, but the average is not much over 50 when the work is well done. On account of the uniformity in size of the fruit, the number of individual fruit in a package of a certain size and style is readily known and is marked on the outside of the box.

CO-OPERATIVE PACKING AND MARKETING.

In many places co-operative associations have been formed for the purpose of facilitating the packing and marketing of fruit. Our Canadian neighbors were the first to take up this method, and have developed it to a marked degree. The following notes, taken from a bulletin on the co-operative apple packing and selling associations in Canada, may be of interest.

It is stated that the organization of these associations was a direct result of the increase in export trade and the consequent necessity for uniform products. Not many years ago, when exporters received their fruit from different parts of the country, they found it necessary to repack in order to meet the demands of the foreign markets. In order to save both time and trouble, these exporters then began to send expert packers into the locality where apples were bought, and packed the fruit either in the orchards or at some central station in the locality.

Later, the growers themselves began to study the demands of the

foreign markets, and soon found that success depended upon the sale of large lots of fruit, few varieties, uniform packing, and the employment of skilled salesmen. In order that these requirements might be met, methods similar to those used by the large private shippers had to be employed, and the co-operative associations were formed.

In 1900 an act was passed by the Canadian parliament, regulating the formation of such associations. The objects of the associations organized under this act were as follows: 1. Uniformity of packing. 2. The adoption of the most economical methods of picking and packing. 3. To secure the picking, packing, and shipping of each variety when at its best. 4. The manufacture or wholesale purchase of packages, such as barrels, boxes, and baskets. 5. The placing of the purely commercial part of the industry in the hands of competent men whose interests were directly coincident with those of other members of the association. 6. To stimulate to the greatest possible degree interest in the improvement of the industry among the less progressive growers. 7. To promote the sale of fruit at the point of shipment. 8. To secure the utilization of surplus or inferior products.

Under the methods used by these associations, all fruit is carefully conveyed in spring wagons directly from the orchards to the packing house, which is usually located on a railway sidetrack. Here the expert gang of packers at once sort the apples into three grades, labeled, respectively: Nos. 1, 2, and culls. The culls are taken away by the grower, grades 1 and 2 are passed into the general stock to be packed under the brand of the association, and credit for same is given the grower. The grower does the picking, because it is claimed that he can do it more cheaply than anyone else, and do it at the right time. It is also supposed that, since he owns the trees, he will use greater care, and less injury to the trees will result. In packing, on the other hand, he is under a disadvantage, because it is difficult for anyone to see worm holes in his own fruit.

The manager keeps an inventory of all varieties grown by his patrons, and they are required to give him an estimate of the quantity which will be produced. From these data he is able to make sales

and guarantee deliveries at stated times. Under this system the small grower who has a few trees is placed on par with the larger producer, in that he virtually combines with his neighbors to market all the fruit of a given variety at one time. As an instance is mentioned Culbert, which is an excellent variety, but which, owing to the small amount of it that is produced on each farm, could not be marketed economically. Under the new system a flourishing trade in this apple has been developed. The cost of packing in these associations is from 10 to 12 cents per barrel.

Before the formation of associations, apple barrels made from the rejected staves of flour barrels cost more than the flour barrels, due to the fact that the cost of selling the apple barrels, a few to each customer, was greater than the selling of flour barrels to the millers. It was also sometimes difficult to obtain the barrels, unless they were ordered a long time ahead, because coopers had no means of knowing just how many would be required. Under the co-operative method, the manager places an order early in the season, and should the supply be greater than necessary, the barrels are stored until the following year. The prices on barrels were in this way lowered, in one case from 40 cents to 30 cents, and resulted in a large saving of expense to the growers. The associations were also able to place the sale of the fruit in the hands of responsible, experienced salesmen, with the result that a much better price was generally secured for the fruit.

Since the success of the entire community depended upon the excellence of the methods employed by the individual growers, each association endeavored to raise the standard of fruit growing throughout its territory, with the result that the fruit of the section was greatly improved. Cultivation, fertilization, pruning, spraying, and even thinning, became established practices among the growers. In the selling of the product, uniform methods of packing have enabled the associations to establish a definite price based on the prices in the principal domestic and foreign markets, and at the present time in many cases fruit is sold to the agents of exporters at a stated price f. o. b. cars at shipping points.

In some cases co-operative storage houses have been established, and in seasons when the price of fruit in early fall does not seem to warrant the sale at that time, it is placed in cold storage and held until better prices may be secured. Organization also facilitated the utilization of surplus fruit and by-products through more effective dealings with the canning and evaporating establishments, or by the construction of such establishments by the associations themselves.

In the United States co-operative effort in fruit disposal has probably attained its greatest development in the Pacific Northwest, and the best known example in that region is the Hood River Apple Growers' Union.

The following statement from a bulletin of the Idaho Experiment Station, in regard to the development and results of the work of this Union, may be of interest:

"Before 1903, Hood River was producing as fine fruit as since, but the price received for Spitzenburg was then about 85 cents. The first year the Union operated the price advanced to $2, and last year the entire output was sold by contract at $2.60 per box."

This may be in part the result of variations in price on the market, but it is safe to assert that it is largely due to the improved methods of packing and marketing. For instance, the Union guarantees every box, and the reputation of the products is such that they are sold on the English markets without inspection. The Union allows no seconds or poor varieties to be sold under the Union label.

The Union aids the fruit growers in other ways, as do the Canadian organizations. For instance, boxes which formerly cost the growers 10½ cents are now obtained for 8½ cents. Lining and wrapping papers are bought by the carload at considerable saving, and hundreds of dollars are saved in the purchase of arsenate of lead and other spraying materials. Since the Union has large sales to dispose of it can afford better business methods, and through telegraphic reports can obtain information regarding prices of fruit in the different markets. Numerous occasions are on record where, through such

reports and through the use of the telegraph by the Union, cars already started towards a market have been diverted to other markets where there was less glut and better prices.

The methods of fruit-growers' associations in the Pacific Northwest vary somewhat. In one case the association accepts the fruit at its packing house, giving credit for the same in a way similar to that in vogue in the Canadian associations. Others send their packers to the orchards of the growers and do the packing there. The orchardist is required to have everything in readiness for the packers when they arrive, and to supply the fruit at the packing tables. Some of the rules issued by these unions, may be of interest:

"Pick all apples as soon as they have attained the proper size, color, and maturity, and save loss from dropping. In picking, be careful not to pull off fruit spurs or stems. Apples must not be bruised, and stems must not be broken from the apples. The union will notify the grower, by mail, when a variety is to be picked, and how. Upon receipt of such notice, pick, wipe, and have all arrangements made for packers, as follows: Packing house, boxes, paper, packing table, nailing machine, nails, etc. Notify the union, as soon as you are advised a variety is sold, when you will be ready for the packers. Packers will be sent to growers in order of notification. In sorting, cull out all wormy, scabby, bruised, misshapen, or otherwise imperfect apples. Packers in sorting at prices agreed upon will not be required to cull out more than eight boxes in one hundred without extra pay."

Further rules are appended regarding the packing table, paper, boxes (an important regulation regarding these is that they must be clean), stenciling (the boxes must be marked with the number of apples contained in each box, name of variety, grade, and grower's number), hauling boxes to the station, number of nails for holding the top and bottom on the box, and the final rule is as follows: "We grow fancy fruit. Our reputation and prices this year and in the future depend on our pack. Do all you can to assist the Board of Directors in carrying out their plans. These requests are made by them for your interest."

From rules of instruction to packers, the following summary may be of interest:

A crew will consist of four packers and one foreman. Each packer must be registered. If any one puts up a poor pack, he must bear the expense of repacking, and if he persists, he is dropped from the list of packers of the union. The charges fixed by the union are 5 cents per box for boxes containing 128 apples or less and for all boxes packing 4½ tier. All 5-tier boxes will be packed at 6 cents. Grower will furnish meals for the packer without charge. If grower is not ready for the packers, they are at liberty to move on, or to charge at the rate of 20 cents an hour for extra time spent in doing work which the grower should have done.

Regarding grading, the following instructions are sent out:

"Only two stings on one apple will be accepted on all first-grade apples. Any worm sting must not be larger than $\frac{3}{16}$ of an inch in diameter, measured from outside of green ring around said stem. No sting may show an open hole. Four and one-half and five-tier apples should not show over one sting, unless said stings are very small. Limb or leaf rub or like defects will be accepted where said defect does not break the skin of the apple, and provided said defect is not larger than a ten-cent piece. . . . . Stemless apples will be accepted only when the flesh of the apple surrounding the said stem is not broken. . . . . Deformed apples will not be accepted. Packers are cautioned to look out for windfalls and bruised apples. Green apples will not be accepted. . . . . Certain special varieties must be wrapped in printed paper, boxes lined, layer paper between layers and on top and bottom. . . . . Spitzenburg sold as red must have 70 per cent or more red color. . . . *Do not pack in dirty boxes.* Everyone should keep his hands clean so as not to soil the paper or dirty the boxes in handling them."

MARKETING BY THE INDIVIDUAL GROWER.

Only comparatively few orchardists are situated where they can take advantage of organized effort, and some suggestions to the individual grower should be added.

Those living near larger towns or cities often have an excellent local market. This embraces the better class of family trade, to which regular deliveries may be made; the large hotels; fancy grocers and fruiterers, all of which take a first-class quality of fruit. Grocery stores, bakers, middle-class restaurants, and hotels require a large amount of good fruit. In addition to these, all the larger cities have commission merchants who make a business of disposing of fruit for growers on the commission basis. Orchardists living at some distance from the larger markets frequently find the commission merchants the most satisfactory outlet for their fruit. Precaution should be taken in making consignments to such merchants, however, since some of them are very unreliable, as is indicated by the number of complaints which one reads in the agricultural papers. If one is not acquainted with any commission merchant in a market where he wishes to ship fruit, it is well to patronize only those who advertise in papers that guarantee the reliability of their advertisers; or, what is perhaps equally good, send only to members of the Commission Merchants' League, which is organized and maintained by the better class of commission merchants for their own protection and for the protection of the consignors. And, finally, put up good fruit carefully graded and packed, label it correctly, and let the world know, whenever possible, where and by whom the fruit is grown.

STORAGE.

Only sound fruit should be stored. This is especially important in connection with cold storage, since the cost is so great that the returns from anything but first-class fruit would not warrant the expense of storing. Windfalls and fruit injured in any way should be culled out and disposed of, immediately after picking, for whatever it will bring. Apples intended for storage should be carried to the storeroom as soon as possible. The old-fashioned practice of leaving apples in piles on the ground, exposed to the sun and weather, is exceedingly unwise for apples intended for storage. If home storage is to be used, apples may be picked, sorted, and packed loosely in barrels or boxes

in the orchard, and carried to the storeroom to be graded later in the season. Apples for commercial cold storage should be graded, sorted, and packed ready for sale in the orchard, and carried as soon as possible to the storehouses. It has been found that a temperature slightly above freezing is best for apple storage. This can only be attained in commercial cold storage. Fairly good results, however, can be obtained by storing in well-constructed, ice-cooled houses, or in good cellars. One grower, L. Hunt, Vermont, states that he keeps Wealthy apples until March by spreading them out, 3 or 4 deep, on the dry earthern floor of a cool cellar. Another stores his apples successfully in the cellar, in bushel boxes placed on the floor and on racks along the walls. Apples so stored should be picked over occasionally and all decaying fruit thrown out.

Some large growers have constructed special storage houses with several walls and air spaces, and find them quite successful. A greater uniformity of cold may be obtained by icing such houses. Farm cold storage may be helped by opening doors and ventilators at night to let in the cold night air, and closing them during the day.

APPLE BY-PRODUCTS.

There is perhaps no fruit that has so many and varied uses as the apple. In the fresh state it is eaten out of hand, and it may be cooked in a great many ways. It may be evaporated or dried and kept for an indefinite period and then cooked in much the same way as fresh fruit. There are also a number of by-products. The juice is expressed and used, according to its age and stages of fermentation, as sweet cider, hard cider, or vinegar. The whole apple, and even the parings from evaporators, are used for apple butter, jellies, jams, etc., and in recent years the culls and cores from evaporators have been dried and sold for $4 a ton for export to Europe, to be returned to us, in part, later in the form of high-priced "imported wines."

In this State but little attention is paid to the by-products, and, with the exception of cider and vinegar, there is probably little thought given to their utilization. Even the old-fashioned way of

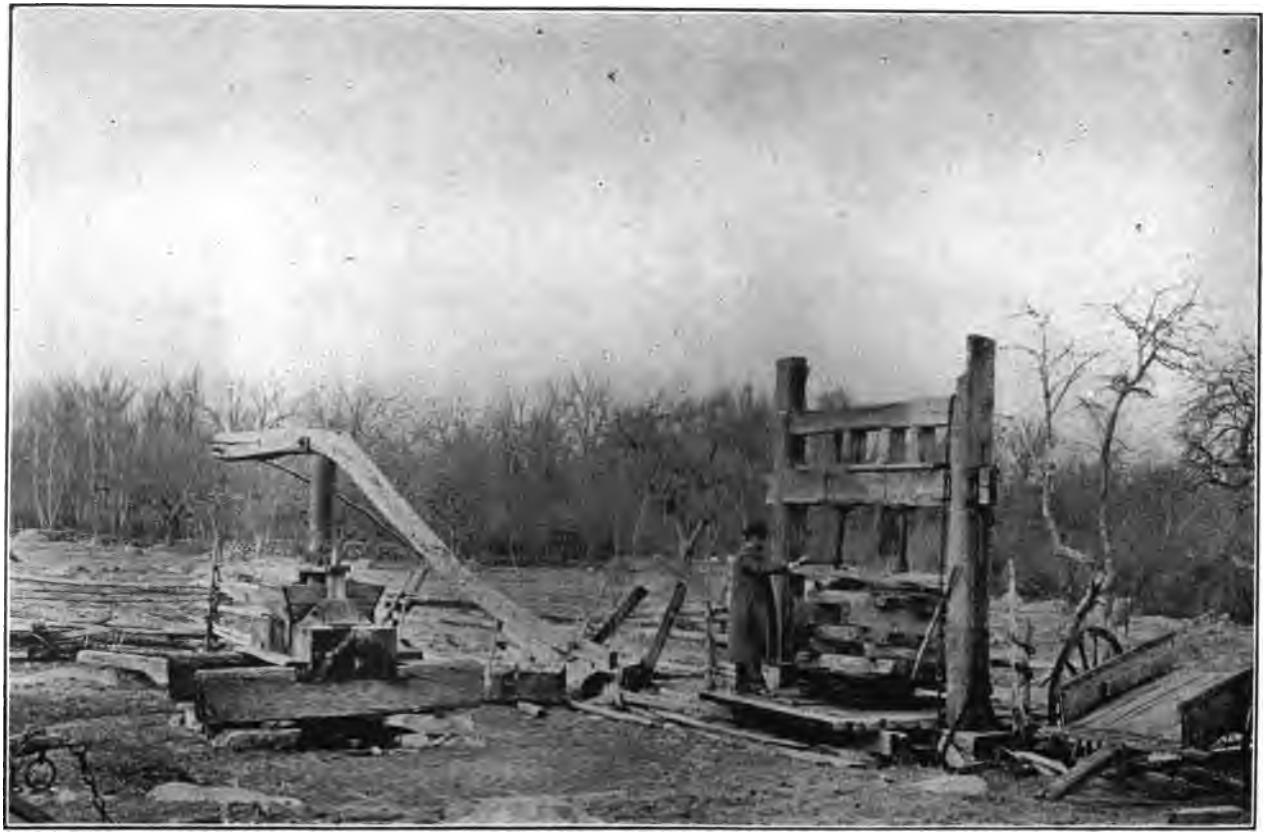

PLATE XXI. Ye ancient cider mill and press.

paring and hanging the slices on strings behind the kitchen stove to dry is probably obsolete, much to the regret, no doubt, of poets who used to sing the history and praises of the dried-apple pie, and of the flies who must look to other things for a roosting place.

The making of cider and vinegar is of considerable importance. As already noted, the last Rhode Island State census, as compiled by the Commissioner of Industrial Statistics, shows that out of a total of 231,735 bushels of apples raised in 1905, 103,648, or nearly one-half, were used for cider.

It has been learned that there are various ways, or methods, of making cider, some good, and some that can hardly be called methods. It has also been discovered that the resulting product varies greatly in quality, and that the prices must differ accordingly. In the altogether too common method, the apples not considered fit for marketing as fresh fruit are gathered, good, bad, or indifferent, dirty and clean, fresh and decayed, ripe and green, sweet and sour, whole or wormy and diseased, and carted to the cider mill, dumped into a grinder wholly unacquainted with any cleaning processes, where the whole load of nondescript fruit, dirt, leaves, worms, etc., is made into a mixture from which a press of like cleanliness forces out a juice that, to anyone who has tasted good cider, reveals, to some extent at least, its heterogeneous origin.

Since cider making is and probably will be of some importance in the State, a few suggestions regarding up-to-date methods of cider making may be of interest. Of course, a first-class product cannot be sold for what the inferior grades will bring, and anyone who will prepare a good quality of cider, and let it be known, will not need to fear but what he can sell it at a remunerative price. In fact, so far as experience indicates, the same rule holds good here as in other lines of production,—that the highest quality of product gives the greatest percentage of profit. For instance, a firm at Rochester, New York, which makes the highest quality of cider, stores it in absolutely clean, glass-lined tanks in cold rooms, and then bottles it, charging each bottle with carbon bisulphide and sealing it, sells its products at a

higher price than some of the better wines will bring. It nets a very large profit to the men who are in the business, and the demand is greater than the supply. The production of such high-grade cider is in its infancy, and there are probably not over six or seven such cider mills in the country.

Of course, such a method of manufacturing cider would necessitate special appliances and probably could not be carried out by each farmer on his own farm. It would be possible, however, for a number of farmers to club together for the purpose of securing the necessary apparatus. If such a co-operative enterprise is not feasible, the making of good cider on the farm is possible with a little care and the use of ordinary methods.

The following notes from an article by Professor Alwood, printed in the New England Homestead, may be of interest in this connection:

"Only good fruit will make good cider. It is not worth while to waste effort on poor, unripe fruit, or on early fruit with a thin acid juice, weak in sugar. The finished product will never be better than what one starts with. Unmerchantable grades of our very best table fruits should be used for home-made cider.

"The fruit should be clean and free from rot. To use unclean or rotten fruit simply invites bad fermentation. If one puts into the cider all sorts of germs found on soiled, dirty, and decayed fruit, he should not expect good results. The fruit should be carefully pulped when it is cool, the juice expressed as quickly as convenient, and put at once into clean barrels. Great care should be used in selecting a grinder. Proper machinery will recover four gallons of juice per bushel. German mills, made with stone grinders, will crush the fruit so that four gallons of juice can be recovered by hand. To my mind, it is far better to pulp the fruit by hand with wooden mauls in a wooden trough than to use some of the modern hand mills. By this method one can extract the juice very effectually. Where only a couple of barrels of cider are wanted for home use, this is not difficult, and one secures juice that will make good cider.

"For drinking-cider use only perfectly clean alcohol or whiskey barrels. Never use a barrel that has contained cider or any other liquors than those mentioned above. An old cider barrel cannot be properly cleansed. Barrels should be thoroughly scalded with boiling

water and washing soda, then rinsed clean with cold water from a pure source. Put the barrels, if possible, in a room where the temperature will be fairly constant at 65 to 75 degrees. Lay flat and fill with juice to within eight inches of the bung hole. Cover the hole carefully with clean cotton so as to exclude the entrance of germs and vermin. This cover readily permits the gases to escape. Never allow it to touch the liquor in the barrel. It is a great mistake to allow the barrels to foam over, as all sorts of germs enter and destroy the cider.

"As soon as the juice is in the barrel, put into it a cup of baker's yeast or, what is better, a pure culture of special cider yeast. This sets up alcoholic fermentation at once and largely cuts off the development of harmful organisms. Fermentation will be more rapid by this method. After three days raise the cotton and note the condition of 'head' on the cider. It should become thick and turn dark, as the first fermentation is completed. As soon as the liquor becomes comparatively quiet it will be found fairly bright and limpid. It should then be racked off into a perfectly clean barrel and every care observed not to carry over any of the lees. If this barrel can be kept at a temperature of 55 to 65 degrees, the results will be better. The hole must be carefully guarded as before.

"A second fermentation will now set in, and as soon as its subsides the barrel can be tightly bunged, and if kept in a cool cellar, the cider will keep for several months. If one is not afraid of using chemicals, each barrel can be treated with about 2½ ounces benzoate of soda, and the cider will keep for a long time without further change. It is, however, better to watch the cider as fermentation progresses, and when it shows specific gravity of 1.004, rack it free from lees into sound clean wine bottles, cork tightly, and store in a cool cellar."